THE REFINER AND NATURAL GASOLINE MANUFACTURER

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Permanent Charcoal Plant Installed for Natural Gas
By Roy C. Munsell

Cracking Processes Dominate Refinery Improvement Program
By Keith J. Franshier

Making Kerosene Carry Its Own Load

Position of Refiner and Natural Gasoline Manufacturer
By J. Von Fibra

Other Interesting Features

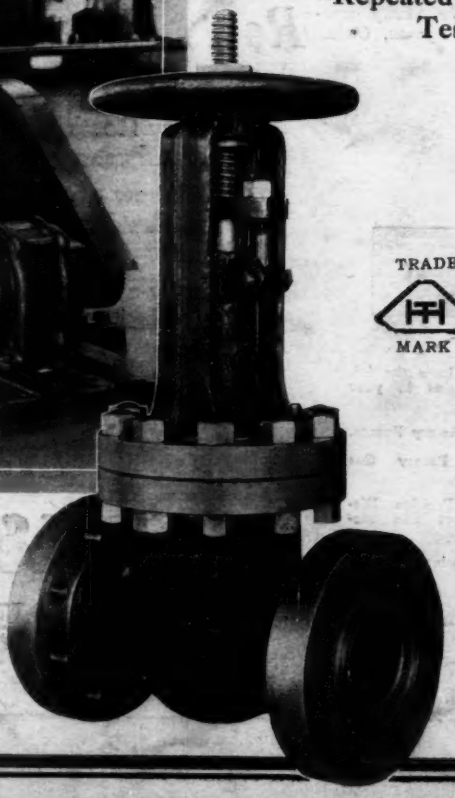
THE JOHN CRERAR
FEB 19 1926

Vol. 5, No. 2 FEB., 1926 $1.00 Per Year

Investigating Endurance Properties of the Steel FOR

HUGHES VALVES

—by means of the Repeated Bending Test



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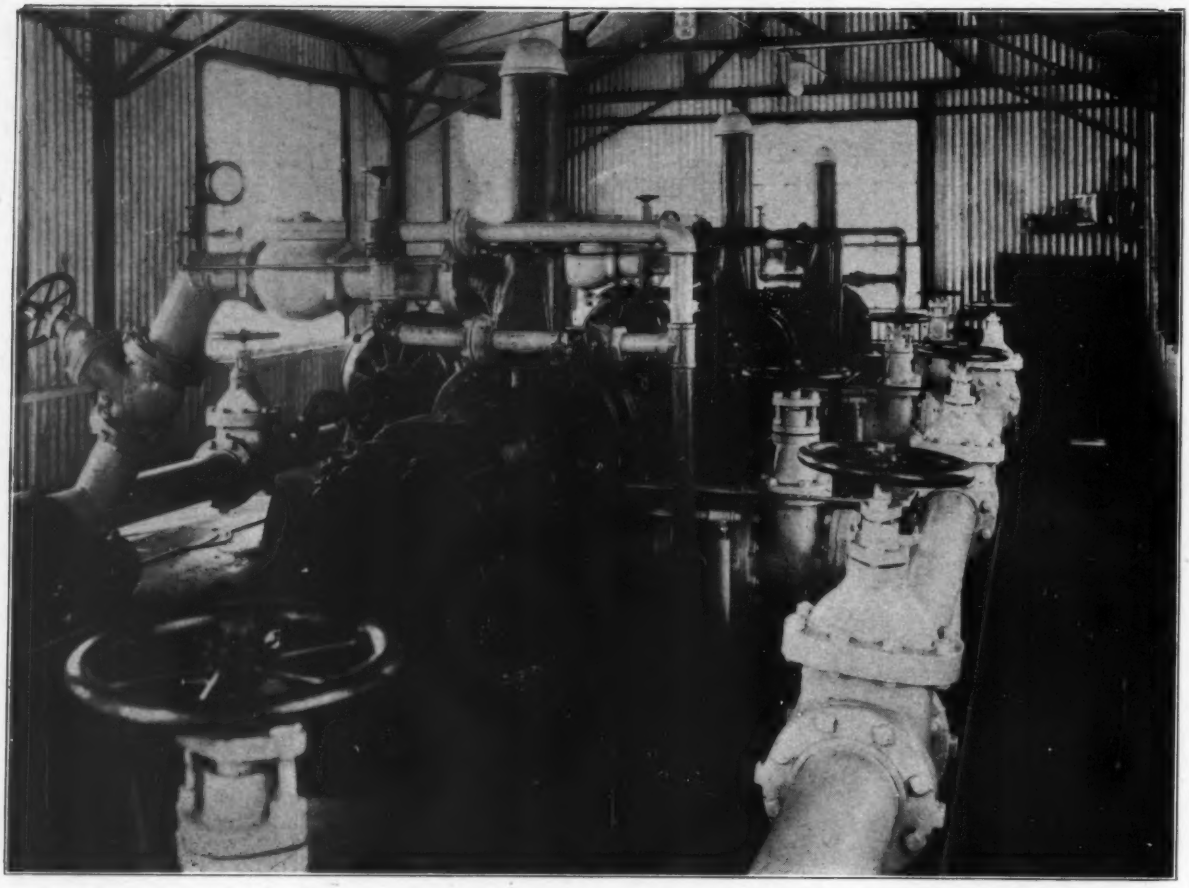

Roots Rotary Pumps in service at the Skelly gasoline plant, Lyman, Okla.

Roots Pumps Eliminate Shutdowns

All Roots equipment is built to last indefinitely. When necessary Roots Pumps operate 24 hours a day throughout the year. Adjustments can be made while pump is operating.

We know of one gas pump that operated 8 years without a forced shutdown. It was then taken down to remove the sulphur.

Sturdy construction, absence of small parts and contact surfaces, elimination of internal lubrication makes this long life possible.

You have only to buy one Roots Pump—they last a lifetime.

Write for Bulletin No. 113

ROOTS

You should have the following bulletins in your files:

113—Roots Rotary Pumps.

108—Roots Rotary Gas Pumps.

111—Roots Positive Displacement Gas Meters.

118—Engineering Tables.

Just ask the nearest office for them.

The P.H.& F.M. ROOTS CO.

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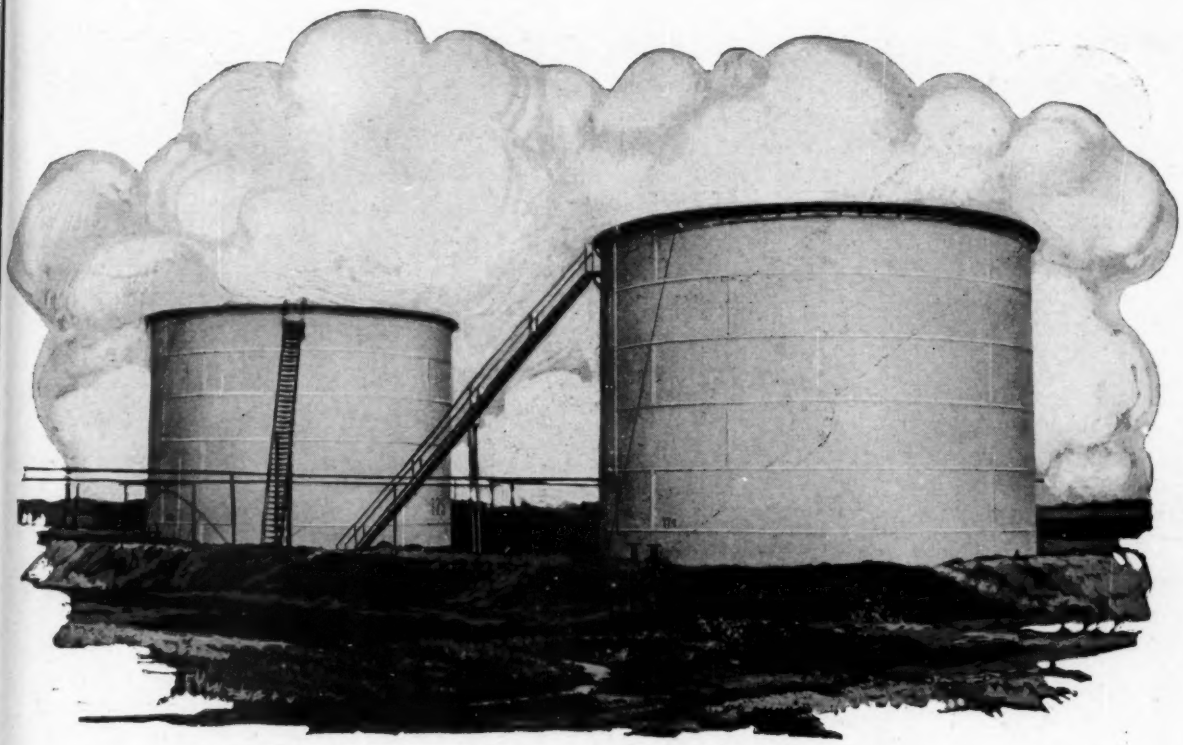

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The use of Degraco Aluminum Tank Paint provides the highest degree of light reflection and the lowest degree of heat absorption that can be obtained by any practical method for cutting down evaporation losses.

Actual field tests have shown that tanks on which this paint is used remain so cool that there is no need to resort to water spraying or other artificial methods of cooling. The result is a saving that amounts to far more than the relatively low cost of painting and maintenance.

Degraco Aluminum Paint is not easily stained by oil leakage — nor is it darkened by hydrogen sulphide fumes as are so many paints when exposed to oil field conditions. The reason for this is that the Degraco Aluminum Paint Formula *provides the right blend of vehicles and pigment* to meet the known conditions of exposure and service.

Send for complete information on Degraco Aluminum Tank Paint including data on tests of its effectiveness in reducing evaporation losses.

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511-12th. St.
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Tell them where you saw the ad.

Cleaners Built to Your Service Requirements

The use of tube cleaners in the oil refineries is a specialized field, requiring a variety of cutting head construction and cleaner motor types to meet the needs of the different sizes of tubes and kinds of scale formation.

Some work requires a powerful, heavy motor; other service a light, speedy motor; some scale requires the use of universal joints and drills; others heavy, long-surface cutting heads, and still others a light head run at high speed.

Our experience applied to your special requirements will give you the exact type of motor and cutting head best suited to your service. Our representatives and cleaner experts are experienced in oil refinery service and are glad to give you the benefit of their knowledge applied to your particular tube cleaning requirements.

Liberty Manufacturing Co.
449 Grant Street
Pittsburgh, Pa.

Z-1029

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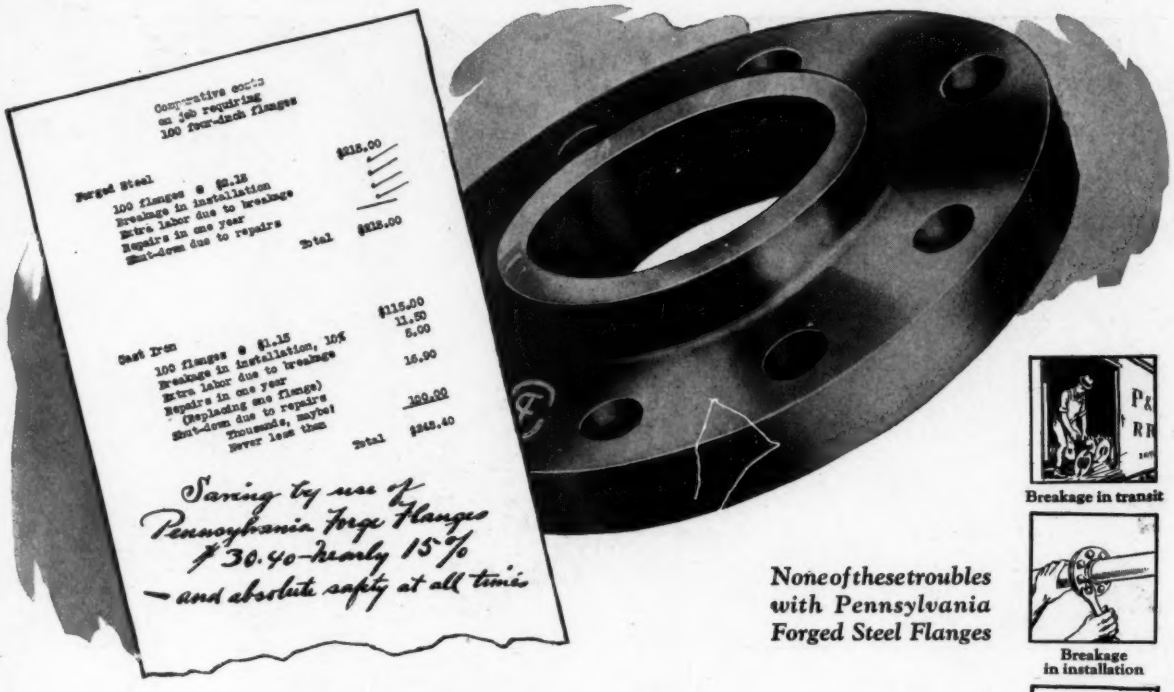
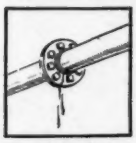


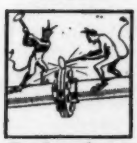
None of these troubles with Pennsylvania Forged Steel Flanges

Breakage in transit

Breakage in installation

Breakage due to vibration


Breakage due to expansion


Breakage due to water hammer

Forged Steel Flanges cost less! Here's the evidence.

DON'T deceive yourself about comparative costs on pipe flanges. Cast-iron may SEEM cheaper than forged steel when you read the quotations, but experience proves that exactly the reverse is true. A typical case is figured out above.

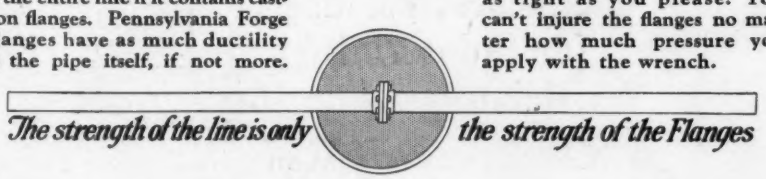
You can never tell whether a cast-iron flange contains a blow-hole or other hidden defect—until too late. Pennsylvania Forge Flanges cannot possibly have any structural weakness.

Cast-iron flanges have virtually no ductility. Expansion, contraction, vibration, or any other movement in a pipe line is almost invariably followed by a shut-down of the entire line if it contains cast-iron flanges. Pennsylvania Forge Flanges have as much ductility as the pipe itself, if not more.

The tensile strength of cast-iron averages 22,500 lbs. per square inch. Pennsylvania Forge Flanges have a tensile strength of 60,000 lbs. per square inch.

Many pipe line leaks are due to loose or damaged gaskets. Full gaskets often fail because the edges are pinched and cut by uneven pressure of flanges. Ring gaskets avoid this fault, but they cannot readily be used with cast-iron flanges, because cast-iron is almost certain to break when bolts are pulled up tight enough to hold ring gasket firmly in place.

Pennsylvania Forge Flanges insure perfectly sealed joints. Pull up the bolts as tight as you please. You can't injure the flanges no matter how much pressure you apply with the wrench.



Authoritative Data Book Free

Chock full of valuable information. Write today for your copy.

PENNSYLVANIA FORGE CO.

PHILADELPHIA

Texas Branch: Harrisburg Pipe & Pipe Bending Co., Houston, Texas. Carries full stock of flanges.

Tell them where you saw the ad

11 Man Hours Instead of 8 Man Days!

Some Matthews Users in the Oil Fields

Pure Oil Company
Pure Oil Pipe Line Company
Skelly Oil Company
Roxana Petroleum Corporation
Standard Oil Company
Magnolia Gas Company
National Refining Company
Pierce Petroleum Corporation
Comar Oil Company
Phillips Petroleum Company
Manhattan Oil Company
Ozark Pipe Line Company
Champlin Refining Company
Johnson Oil Refining Company
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Mid Continent Petroleum Company
Marland Refining Company
Sinclair Crude Oil Purchasing Co.

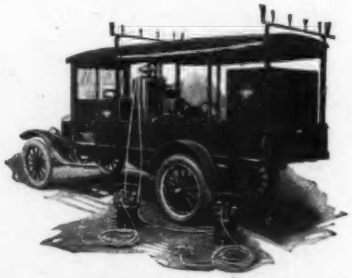
Instead of hand painting their 55,000 gallon tanks in eight man days, the companies listed on the side are painting their tanks with Matthews Mechanical Painting Equipment in an average time of 11 man hours.

Mechanical Painting is not only faster and more economical on tanks, but it can be used as economically on all oil company properties, such as, bulk stations, tank cars, cracking units, refineries, buildings, etc. It averages from 4 to 8 times faster than hand painting and effects a saving of from 50 to 70 per cent in final painting costs.

The Oil Fields have learned to depend upon Matthews Mechanical Painting Equipment because it is sturdily built and will paint quicker and better—at a lower cost. The many oil companies who have standardized on Matthews Equipment is evidence of this fact.

Send for your copy of

"Mechanical Painting for Industrial Maintenance"



W. N. Matthews Corporation
3708 Forest Park Blvd.
St. Louis, U. S. A.

MATTHEWS MECHANICAL PAINTING EQUIPMENT

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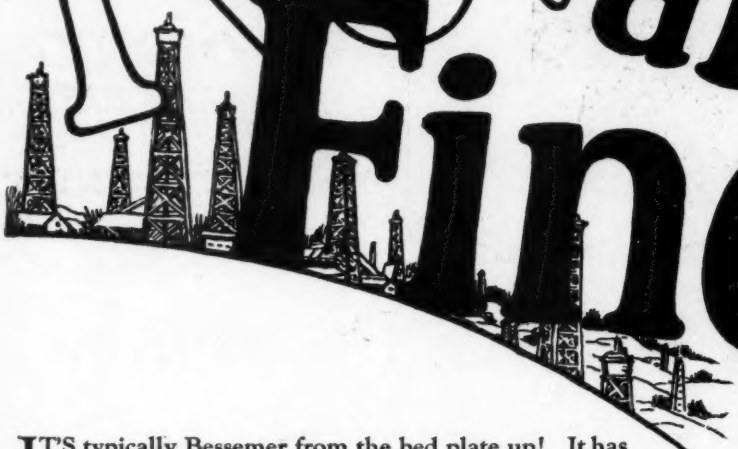
Newest and Finest Oil Field Engine



IT'S typically Bessemer from the bed plate up! It has Bessemers usual low-cost, long running time built in every part!

These are a few of the many improvements and refinements.

First; It's entirely enclosed.

Second; Lubrication is combination force feed and splash, with splash for main bearings, connecting rod and crosshead.

Third; The air valve is placed on the *top* of the bed plate instead of underneath the cylinder.

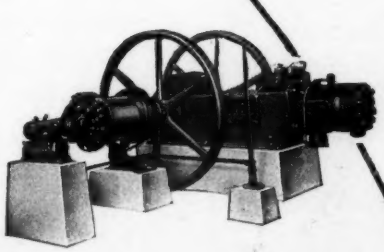
Fourth; The cylinder is bolted on the outside, permitting quick, easy removal of the cylinder.

Fifth; The crosshead guides are bored and the crosshead is fitted with cast iron shoes both top and bottom.

Sixth; The crankshaft bearings are of the box bearing type, easily removable.

Seventh; Larger water circulating capacity, and a 6″ exhaust, and in addition to these, there are many other improvements.

The new Bessemer Oil Field Engine is a real engineering achievement. It is sturdy, simple, economical, efficient—an engine which sets a new high standard.



THE BESSEMER GAS ENGINE COMPANY
18 York St. ∴ ∴ Grove City, Pa.

and it's a BESSEMER

BESSEMER OIL FIELD ENGINES – COMPRESSORS VACUUM PUMPS – ROLLER PUMPING POWERS

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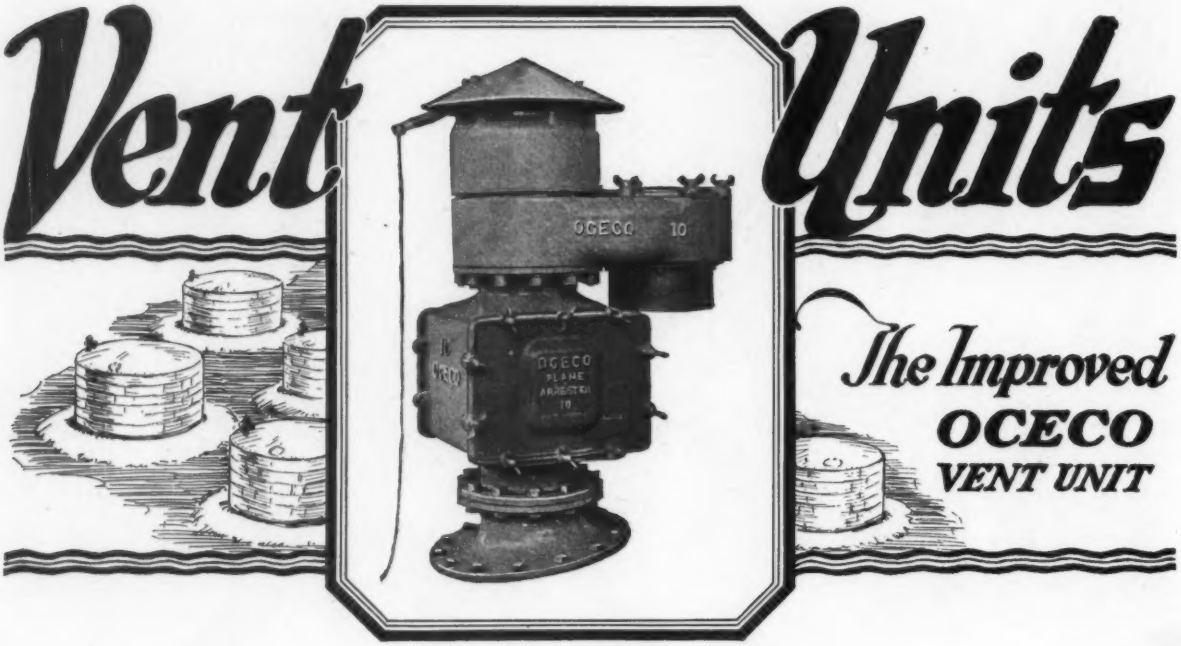
Vent Units



The Improved
OCECO
VENT UNIT

Your Tanks Deserve Protection

A QUALITY product that affords complete protection against fire, helps maintain gravity and reduces evaporation to a minimum.

Consists of double flange vent collar, flame arrestor, conservation vent valve and flame snuffer. For use on gas-tight tankage containing volatile oils.

At the standard setting the breather valve opens when pressure or vacuum exceeds one-half ounce per square inch. (Special settings up to 1 pound. For pressures below ½ ounce use the Superla Tilting Vent).

The flame arrestor is a sure fire stop. Fire has *never* gone through an Oceco Flame Arrestor.

In brief, a quality unit of efficient design skillfully made and sold at a price little if any more than ordinary equipment.

For Small Tanks

2″, 3″, 4″ and 6″ sizes.

For Low Pressures

The Superla Tilting Vent Unit

THE OIL CONSERVATION ENGINEERING CO.
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OIL TANK OCECO EQUIPMENT
SAVES EVAPORATION AND PREVENTS FIRE

Joints!

—eliminate them with PLIBRICO

THEY'RE the cause of big furnace bills in refineries. They cause firebrick to tumble into the furnace.

They allow corners of brick to protrude into the furnace under the strain of expansion and contraction. Corners spall. Bricks crack. The bond is loosened and drops out. Soon relining is needed.

That's why, next time, you should install the lining that has no joints—Plibrico!

Plibrico is jointless. It's plastic. Pound it in with a mallet. Trim it with a trowel. Then leave it alone. Your long-lived Plibrico Linings won't bother you for years and years. Jointless Plibrico stands the gaff.

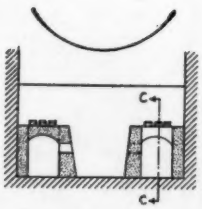
Anyone can install it. There's no stocking of special tile for irregular shapes, such as door arches.

Heat loss through the still setting is decreased and still temperatures can be more closely regulated.

Want to know more about Plibrico? Then don't overlook the coupon.

In 90 Cities

skilled Plibrico experts await your phone call, or telegram. Without obligation, the Plibrico man will get right into your furnace, and tell you what's wrong. He'll instruct your men in the proper installation of Plibrico. Warehouse stocks are maintained in these cities for speedy delivery. See your local phone book or write for nearest address. Plibrico is packed in cylindrical steel, wooden ended containers by a patented method.



The Plibrico Diffusing Furnace

Ask about this dog-house type furnace that decreases furnace maintenance and gives higher efficiency.

(Patents applied for)

PLIBRICO JOINTLESS FIREBRICK COMPANY

1165 CLAY STREET, CHICAGO
Factories: Chicago and Trenton, N. J.

Mail this coupon today for

1—The Engineer

The Plibrico engineer will be glad to call at your refinery to give you the cost of your repairing or relining with Plibrico.

2—The Big Book

"Refractories and Furnace Design" is 32 pages in size. It tells the whole money - saving story. The coupon brings it—no obligation.

Refinery.....
Address.....
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My name.....
To Plibrico Jointless Firebrick Co.,
1165 Clay Street, Chicago, Ill.
R&NGM2-R-RTG

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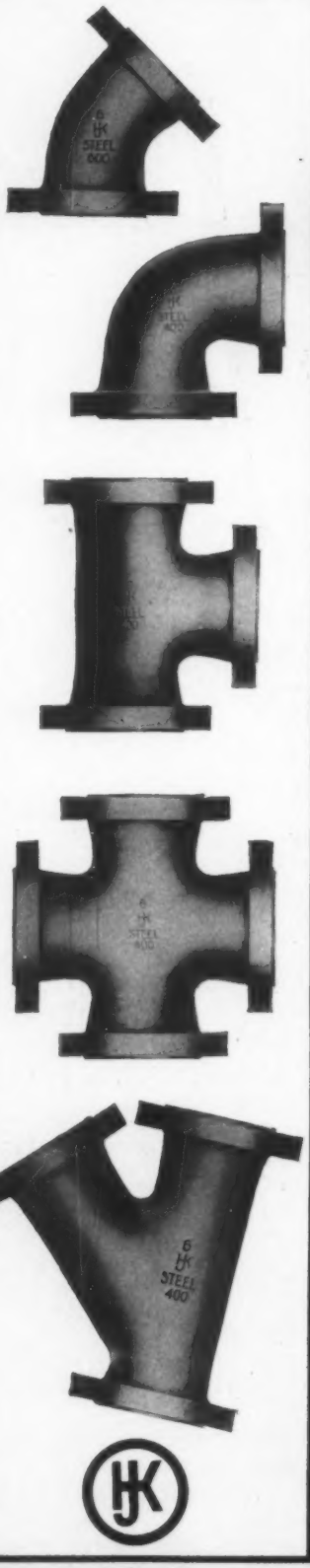

For High Pressure and Super-Heat Service

Modern oil field and refinery operation calls for pressures and temperatures far in excess of limits considered safe a few years ago.

The well known Kelly and Jones line of fittings, capable of withstanding high pressures and temperatures, is made of the highest quality steel and is designed especially for this particular service.

The line is complete and available to meet varying conditions, including pressures for hot oil and steam to 900 pounds; cold water, oil or gas to 1500 pounds; temperatures of 750, steam at 900 pounds pressure and 900 at 600 pounds pressure.

Power Plant Piping, Coils and Headers of all kinds made at our Ectna plant, Sharpsburg, Pa. Write for booklet.

THE KELLY & JONES CO.
GREENSBURG, PA.
GENERAL OFFICES, PARK ROW BLDG., NEW YORK CITY

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KRUZITE · MIZZOU · EMPIRE · CROWN · OZARK

A New Fire Brick Plant

ANNOUNCING our third complete factory at Mexico—each an entire self-contained unit. This new plant has a Harrop Continuous Car Tunnel Kiln. Daily capacity now well over 20 carloads.

A. P. GREEN FIRE BRICK CO.
MEXICO, MISSOURI

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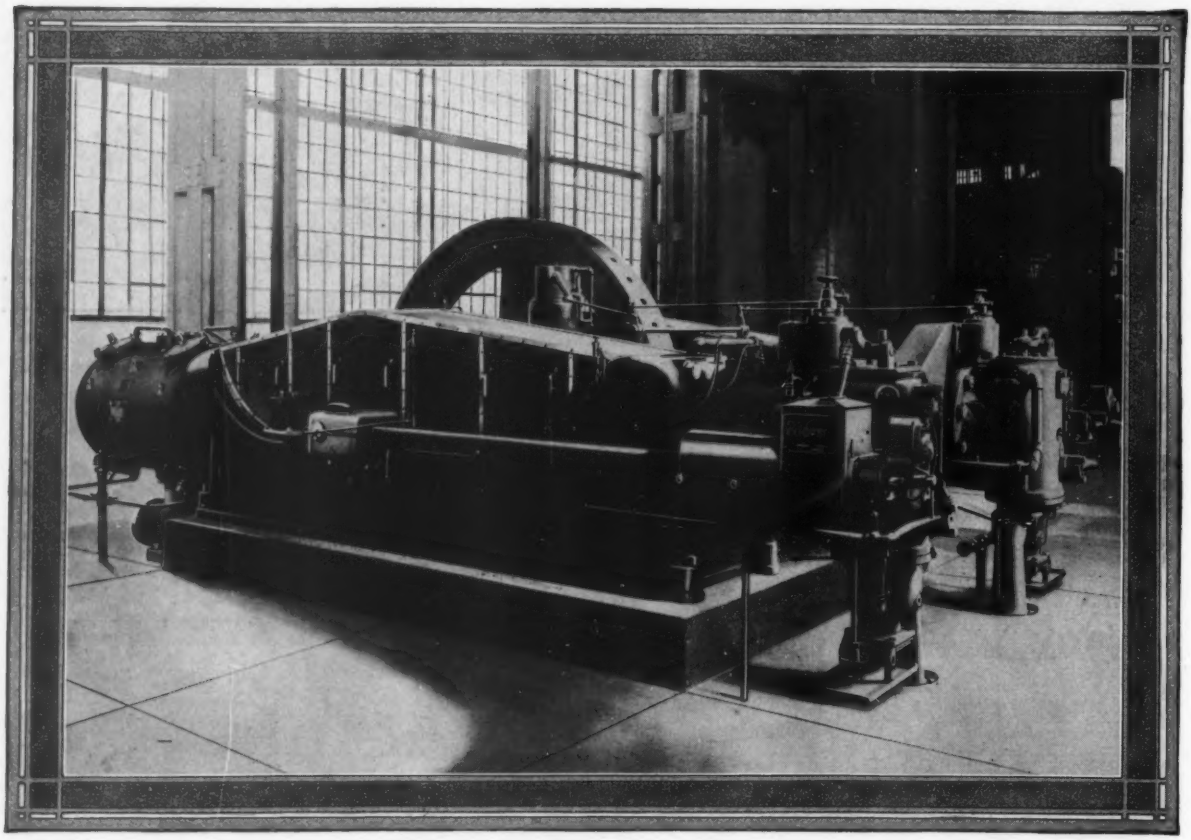

Climbing Higher With Cooper Engines

Four years ago Tom Watson was an engineer in charge of a gasoline plant. (Watson really isn't his name). Tom was a good engineer—kept things looking neat around the plant and was on the lookout for every opportunity to better his operation.

I have just come from congratulating him on his new job of District Superintendent. He didn't tell me in so many words, but I gathered from what he did say that it was the record he made with his Cooper engines which first attracted the attention of the men above him.

Men who have ambitions to climb, from general manager on down, are specifying Cooper engines today, because with them they can show results which win recognition from the men higher up. Cooper engines are helping men everywhere to climb higher on the ladder of success.

THE C. & G. COOPER COMPANY, MT. VERNON, OHIO

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504 Kennedy Bldg., Tulsa

317 Bank of Italy Bldg., Los Angeles

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GRADY TRIPLETT, *Editor*
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HOUSTON, TEXAS
R. L. DUDLEY, *President* A. L. BURNS, *Gen'l Mgr.*
Volume 5 FEBRUARY Number 2

For men engaged in the operating branch of the refining and natural gasoline business

Price.....$1 per year

Advertising rates upon application to nearest office

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Manufacturers Have Valuable Session At Los Angeles Meeting

Los Angeles, California. — Discussions of market conditions supplemented by technical papers devoted to manufacturing practice occupied the one day session of natural gasoline manufacturers at the Annual Meeting of the American Petroleum Institute. This was one of the most interesting and valuable meetings that this department has held and its success assures a prominent place for the subject of natural gasoline on future A. P. I. programs.

Aside from the one day gathering of manufacturers there were several items of interest brought before the group sessions of the American Petroleum Institute. Of particular importance in these sessions was the agreement reached by the Committee on Testing Methods for Determining the Vapor Pressure of Natural Gasoline with Colonel Dunn, chief of the bureau of explosives, that vapor pressure in itself is no index to the safety or hazard of shipping natural gasoline.

Colonel Dunn was also convinced that present rules for shipping natural gasoline should remain in force and that pressure determinations be made with the bomb and by the method known as the bureau of explosives method which is now in general use.

The head of the bureau of explosives before this meeting had been in favor of the Anderson bomb as developed by Dr. R. P. Anderson, technologist of the American Petroleum Institute.

After the discussion at this group meeting Colonel Dunn stated that he would give his approval to the present methods and rules and would recommend to the Interstate Commerce Commission that the proposition be accepted without a hearing. However, it is not known what action this body will take.

At the joint meeting of manufacturers and the A. P. I. a paper read by E. L. Peck, general manager of the gasoline department of the Empire Gas and Fuel Company, and president of the Association of Natural Gasoline Manufacturers, met with considerable interest and was followed by lengthy discussion. Mr. Peck's paper dealt largely with the future possibilities of the industry and touched briefly upon prices and market conditions.

The discussion of this subject was participated in freely by manufacturers from all sections of the country and while their opinions were not always expressed in the same manner their conclusions center around a very prosperous period during the next few years.

Of particular interest in the day's meeting was the paper and discussion by Carl J. Von Bibra on the position of the refiner and natural gasoline manufacturer. Mr. Von Bibra pointed out the possible effects of cracking on the sale and use of natural gasoline and touched on several other angles which are expected to have important bearing upon the future of the industry.

Mr. Von Bibra's paper has been reprinted in full in this issue.

Past and Present Methods of Manufacturing Natural Gasoline was the title of a paper given by F. E. Rice, superintendent of the Gasoline Department, Phillips Petroleum Company. Mr. Rice discussed the portable gasoline plant and its probable effect upon the future of the industry. He also urged that manufacturers co-operate with one another by openly explaining all new knowledge which they have obtained in efficiently operating their plants.

A plant trip including some of the large gasoline plants on the West Coast was arranged following the meeting of manufacturers.

The membership of the Association of Natural Gasoline Manufacturers, which sponsored and arranged the program of the one day gathering, was well represented while practically all West Coast manufacturers were on hand with many executives not directly interested in this branch of the industry but in attendance at the A. P. I.

Research Aided

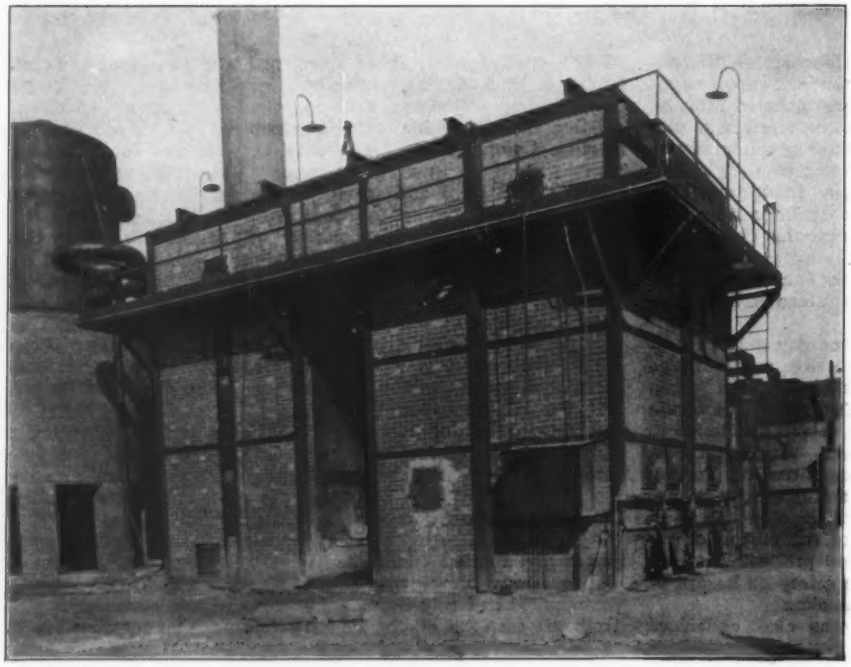
The announcement made at the Los Angeles meeting of the American Petroleum Institute to the effect that John D. Rockefeller and the Universal Oil Products Company had donated a total of a half million dollars to the Institute for research work is naturally a source of gratification to the entire oil industry.

It was predicted at the A. P. I. meeting that these two contributions, each for a quarter of a million dollars, were the beginning of a wonderful fund for petroleum research. Mr. Rockefeller is not a newcomer in the ranks of those supporting scientific research, while the Universal Oil Products Company has, through its own research, made valuable additions to the science of extracting valuable products from petroleum.

The oil industry is to be congratulated upon the highmindedness and the liberality of the man who was a pioneer in the oil industry as well as the firm which has been a pioneer in the development of better methods of oil cracking.

FOSTER

TUBE STILLS



OVER 400 Foster Tube Stills are operating with a high degree of efficiency in topping crude oil, re-running distillates, recovering light oils, continuous distillation, distilling crude coal tar, cracking, producing, lubricating stock, preheating cooling oil vapor, heating asphalt, refining vegetable oils, and many other industrial oil heating operations.

POWER SPECIALTY COMPANY

111 BROADWAY, NEW YORK

Branches in All Oil Centers

Tell them where you saw the ad.

Position of Refiner and Natural Gasoline Manufacturer

By Carl J. von Bibra

Export Refining Company, Presented Before the Annual Meeting of the American Petroleum Institute at Los Angeles

IT is not the purpose of this paper to propose any new specifications for natural gasoline, or to suggest any modifications in its manufacture. The viewpoint from which this is written is that of the California refiner rather than that of the manufacturer of natural gasoline.

The object in view is to stimulate thought along lines which will help both the refiner as a purchaser of natural gasoline and the gasoline manufacturer as a seller of a single commodity having but one buyer. It is obvious that the refiner will buy natural gasoline only so long as he can make a profit by doing so. It is therefore incumbent upon the natural gasoline manufacturer to furnish the refiner with a commodity which it will be profitable for him to buy, not only today and perhaps next year, but over a long period of years, for only in this way can the natural gasoline manufacturer assure the stability of his business with its large investment in plant and pipe lines.

At the present time in California, the natural gasoline market is entirely in favor of the gasoline manufacturer. There is an actual shortage of natural gasoline in this state. Current stocks of the product have dropped month after month until they are now a little less than a three days' supply. It is improbable that a further shrinkage in stocks is possible, as a three days' supply represents practically nothing more than the amount of gasoline which it is necessary to retain in the shipping and receiving tanks of the seller and buyer to take care of current movements, and in addition the actual amount of gasoline in transit.

A mere matter of three years ago, natural gasoline in California was selling in large volumes at 5 cents a gallon, and even less. As a matter of fact, there was a period of several months during which there was absolutely no market at all. None of the refiners wanted to buy it at any price. At the present time contracts for delivery over periods of 1 to 5 years are being entered into in which the prices to be paid the natural gasoline manufacturer for his product vary from 3 cents under the open market price for gasoline at service stations at Los Angeles or San Francisco (tax excluded), to as high as one-half cent "under." Spot sales are negligible as practically all the natural gasoline produced in California is now contracted, but such few sales as actually are being made vary from 1½ cents "under" to a slight premium. With finished motor gasoline bringing the refiner anywhere from 6 cents to 8 cents under the retail market at refinery or tidewater, it is obvious that no money can be made by refiners from the use of such high priced natural gasoline unless the use of this natural gasoline enables them to make a real profit in other ways. This matter will be given consideration in a later portion of this paper.

Business Good

In a market such as that which is at present being enjoyed by natural gasoline in California, the refiner very naturally attempts to make a marketable motor gasoline by using as little natural gasoline as possible. It happens that this winter particularly keen competition has developed among the major marketing companies in providing the motoring public with exceptionally quick starting gasoline. This unquestionably has redounded to the great benefit of the natural gasoline manufacturer since it is impossible just now for the California marketing concerns to make a quick starting gasoline in quantity except by the liberal blending of their straight run refinery product with natural gasoline. There is, however, absolutely no reason to believe that such conditions will continue for very long.

Practically all of the major refiners of California have at present well developed and large scale programs for the installation of efficient and thoroughly tested cracking processes. Some of these cracking plants are now under construction; others are due to be started very soon. The result of all this activity will be that in the latter part of this year, and certainly by the spring of 1927, there will be produced in California very considerable quantities of cracked gasoline, whereas at the present time the production of this commodity is practically negligible. The cracking plants now being installed or contemplated will be able to furnish the refiners with practically any required quantity of low boiling hydrocarbon fractions at a cost comparable with the cost of producing cracked motor fuel. These low boiling fractions of cracked gasoline can be cut so as to practically duplicate natural gasoline in all respects with the exception of gravity and odor. We can safely discount the disadvantage of the odor of this product since there is absolutely no question but that the public will be educated to use cracked gasoline, either alone or blended with the straight run refinery product, just as the public east of the Rocky Mountains has been educated to do the same.

Likewise, we must consider the question of low gravity cracked gasoline. At the present time much natural gasoline is being bought by refiners, not only to give the low initial boiling point and the quick starting property which comes with it, but also to give a high gravity to the finished motor gasoline. Assuming proper boiling range, we all know that high gravity is all nonsense, except for one consideration. This consideration is that the public mind has for many years associated high gravity with good gasoline and therefore there is a very definite advertising value in marketing a high gravity gasoline. Nevertheless, it will be very much cheaper for the marketers of motor gasoline to spend considerable sums of money in educating the public out of this high gravity notion rather than to pay tribute indefinitely to the natural gasoline manufacturer for his product when a synthetic product can be substituted at a lower cost. This is a very serious matter for the natural gasoline manufacturer and should not be dismissed lightly.

Prefers Natural Gasoline

The way the matter stands now, the refiner would prefer to continue the use of natural gasoline as a source of low boiling hydrocarbons rather than to manufacture by cracking what would be substantially a synthetic natural gasoline. Cracking is expensive, both as to initial investment and operating charges. It is dangerous at best and the manufacture of a rather narrow cut of low boiling hydrocarbons would be even more dangerous than the manufacture of the full range of hydrocarbons comprising motor fuel. This is because it would be necessary to operate at higher pressures and temperatures in order to crack a predominant amount of low boiling hydrocarbons. Then, again, there is a question of royalties to the licensors of the various cracking processes. This would argue against the manufacture of a synthetic natural gasoline substitute, but none of the arguments would be strong enough to induce the refiner to continue to buy

natural gasoline of poor specification or at an unduly high price rather than to manufacture a suitable substitute by cracking.

Mid-Continent Situation

The tendency of the California natural gasoline manufacturer will be to reply immediately that oil is being cracked in very large quantities in the Mid-Continent and on the Atlantic Seaboard, and apparently this has not hurt the market for natural gasoline in those sections of the country. This may or may not be true. Then, again, it is dangerous to compare gasoline marketing conditions east of the Rockies with those on the Pacific Coast. East of the Rocky Mountains we have a very large number of competing retail marketers of motor gasoline. Many of these are comparatively small concerns. With the exception of the area immediately surrounding Los Angeles, this is not the case in California or the other Pacific Coast States and their contiguous territory.

Many small refiners are operating in the Los Angeles area who would not be financially able to install and operate cracking plants of importance and therefore presumably would continue to be indefinitely in the market for natural gasoline in order to make a quick starting gasoline which would compete at all times with the products of the larger companies. Once outside the Los Angeles area, one finds that the retailing of gasoline on the Pacific Coast is almost exclusively in the hands of a small group of major companies, practically all of whom are now installing, or about to install, cracking plants. Therefore, if the major California refiners should be forced, on account of the condition of the natural gasoline market, to dispense with this product to any considerable extent, the small refiner of the Los Angeles area would be totally unable to absorb enough natural gasoline to maintain the present scale of prices. Consequently, California manufacturers of natural gasoline would be making a dangerous comparison if they judged the probable effect of cracking on the California natural gasoline industry by the effect large scale cracking has had on that industry east of the Rocky Mountains.

Lowered Quality

In conversation with the writer one of the most prominent men in the California natural gasoline industry recently advanced the idea that the California marketing companies will have no object in buying high priced natural gasoline for blending purposes as soon as the retail gasoline market changes in favor of the seller. Ever since the present period of overproduction of crude started several years ago the California gasoline market has been strictly a buyer's market. An ever increasing number of marketers have been and still are in extremely severe competition with one another on the Pacific Coast. All of them have a great deal more gasoline to sell than their share of the market can possibly consume. The result has been the usual sad story of lower prices, larger and larger differentials to resellers, better and better gasoline, palatial service stations and an absolutely ridiculous amount of expensive service to the motorists. The portion of this selling program which affects the natural gasoline manufacturer is the refiners' necessity of selling a very high grade motor gasoline.

Several years ago, the California refiners used to weep on one another's shoulders because of the strictness of the U. S. motor gasoline specifications (then the so-called Navy specifications). It was common practice to manufacture two grades of gasoline, one for sale in those cities which had adopted the Navy specifications, or else their own specifications very similar to the former, and another gasoline for sale elsewhere. This was the so-called "country" gasoline. This product had a considerably higher end point than the 437 degree Fahrenheit end point required by the Navy specifications, and did not attempt to meet any of the intermediate points. On the present market this old time "country" gasoline could not be sold at all and United States Government specification gasoline is considered of such inferior quality that only gasoline "bootleggers" attempt to sell it at cut prices. As previously pointed out, all of this is simply the result of the keen competition between the California marketing companies.

Turn in the Market

Now for several years, we of the California oil industry have said to one another that "Next year things ought to start looking up. Consumption is steadily catching up with production and when we start drawing on stocks, prices certainly ought to rise." Despite the fact that each year for the last three years has seen this era of rising prices always a jump or two ahead and we so far have not been able to catch up with it, it is nevertheless absolutely certain that this expected turn in the market will come sooner or later.

The writer, by necessity, like every other oil man, being a hopeless optimist, feels that the expected draught on stocks will come very soon, probably within the current year. When that turn comes, the various large marketing companies who have been storing crude and tops for several years at enormous expense will have to retail gasoline at a much higher price than that now obtaining in order to recover the cost of storage and make a reasonable profit on the oil stored. We will then see a definite change in the quality of the gasoline offered the motoring public. There will no longer be any object in making a fancy motor gasoline by purchasing high priced natural gasoline for blending when the stimulus of cut-throat competition is removed from the refiners. We will then be in an era in which more gasoline is required by the public than is available by crude distillation or natural gasoline manufacture and it will therefore be possible to sell gasoline which is much inferior to the product at present being marketed on the Pacific Coast.

It is doubtful whether the quality of gasoline which will be sold when this expected turn in the market comes will deteriorate to the point reached several years ago when the 140 degrees Fahrenheit initial boiling point was considered entirely satisfactory. If it were not for cracking, there is no question but that we would go back to high initial motor gasoline. However, the large scale introduction of efficient cracking processes will in all probability check this tendency. The cracking plants will be able to bridge any gap between the demand for gasoline and the supply of the straight run and blended product.

Therefore, it is safe to assume that competition will continue between the marketing companies, each of them trying to sell as much as possible in any given territory. However, this competition should be much more reasonable than the competition now prevailing if for no other reason than simply because the competition will then be to sell a product which has to be especially manufactured for the demand whereas the present time it is necessary for the marketing companies to sell as rapidly as possible a huge stock of surplus material which cannot be held in storage except at a high cost.

Dangerous Situation

Despite the fact that it appears logical to assume that the quality of gasoline sold on the Pacific Coast during the next seller's market will not be as poor as that sold during the last such market, there is considerable danger in the situation for the natural gasoline manufacturer. Any lessening of the necessity for the production of a fancy quick starting gasoline by the refiners will immediately be reflected in a lessened demand for natural gasoline. The relative lessening of this demand will be directly proprotional to the extent to which the refiners and marketers return to the standards of motor gasoline which were prevalent here in 1921.

Usefulness of Natural Gasoline

Natural gasoline, as previously pointed out, is useful to the refiner in two ways. In the first place, it gives the low initial boiling point in the finished motor gasoline which is required by the present competitive state of the gasoline market. Secondly, it enables the refiner to realize a profit on the sale of certain gasoline hydrocarbons which it would otherwise be necessary to dis-

(Continued on page 46.)

Next Few Years Hold Prosperity For Natural Gasoline

By E. L. Peck

President Association of Natural Gasoline Manufacturers

While it is evident that natural gasoline is now "out of the woods" and prosperous times are assured for at least the next few years, it is urged that manufacturers proceed with caution and consideration. A relaxation in efforts, or a feeling of over confidence would do much to put the industry back in its unfavorable condition of the past half decade.

What may be expected in the future is shown in the accompanying discussion which is an excerpt from Mr. Peck's speech before the Annual Meeting of the American Petroleum Institute in Los Angeles.—The Editor.

NATURAL gasoline by its inherent nature, does not lend itself readily to storage of surplus over long periods of excess production, or during periods of minimum consumption, as to most commodities. Neither can we slow down production, for we have practically no control over the rate at which our raw material, casinghead gas, is delivered to our plants.

In spite of the fact that the figures of the United States Department of Commerce, for the last half of 1925, show that there was seldom more than three or four days' supply on hand in storage at our plants, we often find it very difficult to command a market which will yield a fair return on our plant investments. Therefore, it is highly important that we strive to broaden our markets and thus keep consumption in closer step with our uncontrollable rate of production.

This condition can also be bettered by each manufacturer providing himself with sufficient storage capacity to at least carry his production over usual periods of minimum consumption. This is not always practiced, and the result is that the failure of a few is sufficient to break the market in a district or even in the entire industry.

Benefit will also result if the manufacturer will not entirely depend upon a fickle market to absorb his output from day to day, but will arrange for his market well into the future, either by maintaining a good selling agency of his own, or by making definite connections with other sales organizations.

Natural gasoline, along with all kinds of motor fuel in general, is burdened with some specifications which are either too strict, or are impractical, and which add to our legitimate manufacturing costs and thus increase the cost to the ultimate consumer. Many of these specifications, such as plus twenty-five color, doctor test, sweet odor, very low end point, etc., mean little if anything to the average motor car operator and from a practical operating point of view could be greatly modified and thus reduce costs all along the line. Some progress is slowly being made to eliminate unnecessary rigidity in gasoline specifications and it is a problem to which we should all give assistance at every available opportunity.

First Plants Simple

During the early days of the life of our industry, natural gasoline plants were fairly simple in design and low in construction and operating costs as compared to the highly perfected plants of today. During those days of small competition and relatively plentiful supply of casinghead gas, a simple contract and schedule for determining the sale price of casinghead gas sprung into existence between the gasoline manufacturer and the casinghead gas producer.

The schedules which determine the percentage of the gross sales price of the gasoline, which is to be paid to the producer for his casinghead gas, have been demanded and retained in use with few exceptions up to the present time. However, the other conditions of the contracts have been added to from year to year, usually with the result that additional requirements have been demanded at the expense of the gasoline plant operator. Many of these changes of course would naturally result from the normal operation of the law of supply and demand, but part of the basic principles involved in this kind of sale appear to be wrong when it is analyzed.

The natural gasoline producer has experienced, during the past five years, many intervals when the price received for natural gasoline was below the actual cost of manufacturing, under existing schedules of prices paid for casinghead gas. On the present basis of purchasing casinghead gas, the natural gasoline manufacturer must bear the burden of these losses and pay a fixed percentage of the gross selling price for his gas supply, even though he may be operating at a loss. Also, he takes the entire risk, which is no small one, on the plant investment involved in the utilization of casinghead gas.

It would seem that a more equitable basis could be worked out, whereby the vanishing point of profits, during periods of depressed markets, would more nearly coincide, as between the producer and gasoline manufacturer. Such a basis could undoubtedly be approximated and surely every one concerned would profit thereby. With part of the hazard removed, many plants would be built and could be profitably operated in fields which are now passed by, or in which old plants have been shut down. A market would result for a much larger percentage of the total amount of casinghead gas produced than at present, and it would be to the economic advantage of the country as a whole.

The question of establishing a fair base price upon which to contract the sale of natural gasoline has always been a troublesome one. A similar difficulty has prevailed in contract sales of refinery gasoline. It would appear that these difficulties always will prevail, so long as the industry is willing to make its wholesale market price a speculative thing, based upon tank wagon prices, retail prices or upon anything other than the costs of the raw material entering the product and its cost of manufacture, making due allowance for the normal fluctuations resulting from the economic law of supply and demand. What logic is there to back up the practice of basing the price of natural gasoline on a tank wagon price of motor gasoline in a district so far removed geographically that an entirely different set of business conditions may prevail than exist in territory where the product is manufactured? Why should the market price of natural gasoline be based on that of refinery gasoline, when the raw materials entering into its manufacture are entirely different both as to source and cost?

The natural gasoline industry, as well as other branches of the petroleum industry, will never obtain the stability of market prices which other basic industries enjoy until they make a thorough study of manufacturing and marketing costs and cease to sell their product at a loss, but instead demand a reasonable and legitimate return on their invested capital. Satisfactory methods of arriving at a base market price have been accomplished in practically all other lines of business and it can be done in the natural gasoline and other branches of the petroleum industry when we learn to think deep enough to seek out the basic facts and cease to follow old practices when they no longer fit existing conditions.

One thing that is of great assistance and benefit in establishing reliable market prices is to truly and truthfully cooperate with the various trade publications and government agencies which publish market statistics and records, and to insist that those publications and agencies present the facts accurately and without bias in statements which accompany them. Individuals cannot often obtain desired changes or improvements in the general statistics of their business, but a united industry can most certainly bring about beneficial results.

We hear and read much these days

about the improvements in cracking processes and equipment for the further reduction of crude oil into motor fuel, and also of the superior qualities of cracked gasoline, and its supposed nondetonating or anti-knock qualities, and increased volatility. The great volume of publicity on this subject almost assumes the status of propaganda, and if we believe all we hear it would appear that natural gasoline would soon cease to be a necessary component in the manufacture of the best grades of motor fuel.

Of course, it is hard to imagine that the inherent anti-knock and high volatility qualities of natural gasoline, when properly blended with refinery gasoline, will ever be surpassed or dispensed with, nevertheless, it may not be amiss to give a little thought to the distant thundering. The natural gasoline industry as a whole would undoubtedly profit by making further scientific study of its product, for the purpose of convincing the refiner and educating the consuming public, as to the beneficial and superior qualities of natural gasoline when properly introduced into motor fuel, and then make sure that the entire motor fuel consuming world is told about it.

For the past several years we have been entering the era of very large, or supernatural gasoline plants, wherein the entire casinghead gas output from large fields or pools is passed through one gasoline plant. The production of some of these plants ranges from forty to seventy thousand gallons daily. These plants are the dream of all natural gasoline manufacturers, but unfortunately they are seldom obtainable. The increasing competition in the business tends to split the fields and plants into smaller units, and today we have started into a period of portable and semi-portable plants, which often make it possible to start operations while the casinghead gas supply is limited to one or two wells which are in highly flush condition. The advent of the portable plant will undoubtedly result in the utilization of considerable casinghead gas which was formerly popped off in the air and wasted. They will also result in many failures, from an earning point of view, to the new comers in the business who are made bold by the reduced plant investment cost, but who still have much to learn about the hazards and obstacles of our business, and that there is a wide gap between installing and starting to operate a gasoline plant and in eventually deriving a profit from that investment. During this period of experimentation, enlightenment and discouragement of new operators, the industry as a whole will undoubtedly suffer somewhat from competition in obtaining supplies of casinghead gas. We will also have at least temporary periods of over production and the usual breaking of markets by inexperienced marketers, who are usually inadequately financed for the certain periods of depression, which our industry has always experienced.

One important factor, which is being realized more and more each year by the oil producer who has casinghead gas for sale, is that there is a worth while superiority in the service rendered, and usually an increase in his income over the life of the project, if he sells his gas to a well established and experienced natural gasoline company, rather than to one which is not substantially organized for this business.

Notwithstanding the various difficulties to be encountered and problems to be solved, which have been enumerated, we can, however, when all phases of the petroleum industry in general are taken into consideration, predict with certainty better and more prosperous times for the natural gasoline industry over the next few years. All statistics and opinions indicate that the petroleum industry, with which we are inherently linked, is entering upon a period of greater stability, which is mainly brought about by production and manufacture being brought more nearly into phase with demand and consumption. However, we should guard against a relaxation in our efforts, or a feeling of over-confidence, but instead put forth still greater efforts to bring about conditions which will minimize, if not eliminate, some of the trying times which we have passed through in the last half decade.

We are now entering a period when we can well give some thought to the solution of problems which are common to the industry and to which we all can and should contribute in our proper proportion.

It is a time when we should look beyond the immediate problems which arise from day to day, and should look into the future for a period three, five or even ten years, and see if by united study and effort we cannot improve the conditions which now exist, or are forecast for early development. How much better it would be, if all the best minds of an industry combine on these common problems, rather than each company or individual continue to work alone, each probably in a different way and each entailing the same expense as a united undertaking, but not with the same sure certainty of successful completion and adoption by the industry. Work of this nature can be greatly hastened to completion and greatly decreased in cost, if undertaken by the industry as a whole through the medium of our various trade associations.

In our business, the Association of Natural Gasoline Manufacturers, though not old in years, has through the united efforts of its memberships, undertaken and successfully accomplished some Herculean tasks, the results of which have been highly beneficial to the industry as a whole, and of which we are justly proud. Although its membership does not include some natural gasoline manufacturing companies, more particularly in the eastern and far western parts of the United States it does include most of the leaders in the industry and its combined membership produces approximately sixty per cent of the total natural gasoline produced in this country. Those companies and individuals most actively interested in the work of this association see a value in it far above the nominal annual dues, and with each additional member that value is increased. All problems undertaken are of vital and universal interest to the industry as a whole, and our problems have not all been solved by any means.

Therefore, a cordial and earnest invitation is extended to all companies who are not now members of the Association of Natural Gasoline Manufacturers to join with that Association in its effort to keep natural gasoline in its original place in the petroleum industry. With your support, which in justice is due to such a promising and far reaching undertaking, we do not hestitate to predict a bigger and brighter future outlook for natural gasoline.

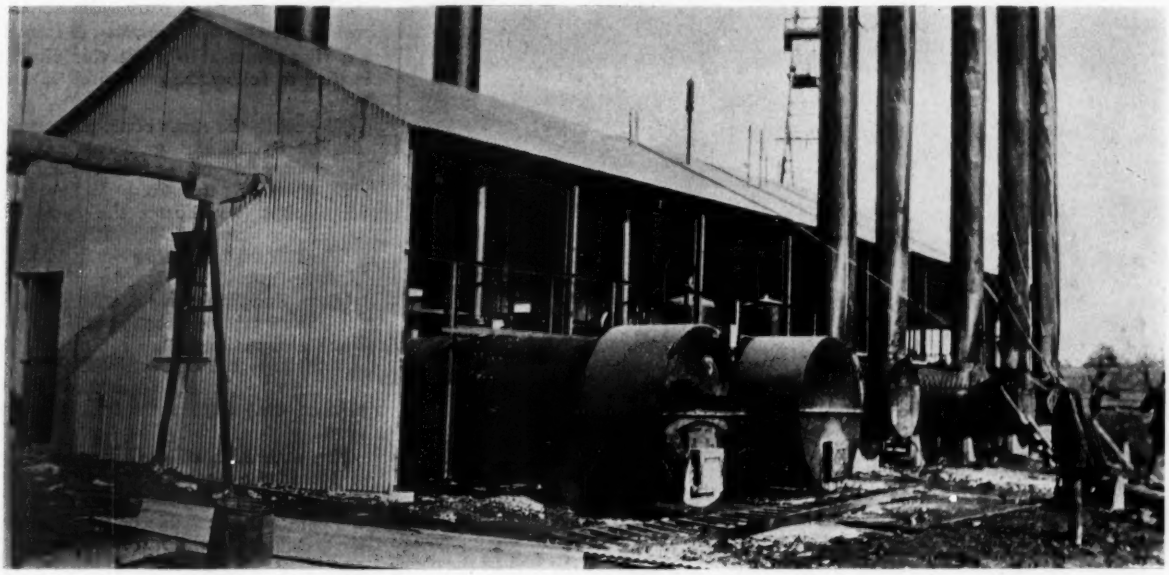
Refiners Preparing for Big Meeting

Tulsa, Okla.—Climaxing one of the greatest years in the history of the Western Petroleum Refiners Association, the fifth annual convention which will be held in the Texas Hotel at Ft. Worth, Texas, March 2-3-4, promises to be one of the most important held by the refiners. The annual convention will bring representatives of practically every refiner in the middle west together for the discussion of many questions of vital interest to every person connected with this industry.

Programs are being arranged to appeal to every division of the refining industry, from the executives down the line, Howard Bennette, managing director, announced. The address of the President, F. A. Pielsticker, and group meetings for traffic managers, salesmen, credit managers, plant superintendents and others will feature the first day's program. On the second day the technical discussions, which will be one of the features of the entire convention, will be held. An interesting and comprehensive program, embracing practically all of the problems which have been a source of trouble to the industry, is being arranged. The annual banquet will be held on the second night, under the present schedule. Officers for the coming year will be elected on the final day of the convention.

Additional plans will be discussed for the advancement of the broad economic, legislative and educational program which is now being fostered by this association.

Present officers who are taking a leading part in associational matters are: F. A. Pielsticker, president; George Locke, Pat Miskell and Roy B. Jones, vice-presidents, and Howard Bennette, managing director.



Boiler installation for supplying steam to distill saturated charcoal

Permanent Charcoal Plant Installed For Natural Gas

Skelly Oil Company adopts method at Davenport after success with Stroud venture

By Roye Munsell
Staff Representative

THE Skelly Oil Company has just placed into operation in the Davenport field, Lincoln County, Oklahoma, a charcoal plant for the recovery of gasoline from virgin natural gas.

Previous to this, and for some time, the Skelly company has operated on a smaller scale, such a plant on their lease near Stroud. The successful performance of that plant and the information derived therefrom led to the installation of the larger and more permanent plant in the Davenport field.

The field of application of the direct charcoal process seems to be confined to lean and only moderately rich virgin gases, but the recovery from such gases by charcoal adsorption makes the undertaking not at all unprofitable.

The virgin gas from the field enters first a horizontal scrubber. From the scrubber chamber it passes into an inlet header leading to the charcoal chambers.

Flow System

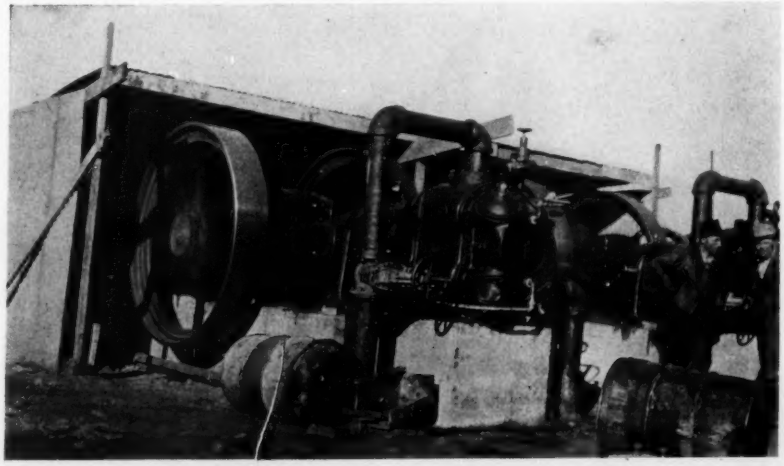
Three such charcoal chambers are provided and placed in parallel. Each contains a layer of activated charcoal which is surrounded by fine mesh perforated alloy screen and supported on a grating. The charcoal chambers are of the horizontal type and are insulated to the lower level of the charcoal bed.

The fresh gas at low pressure passes first into one chamber until the proper saturation of the charcoal is obtained. Then the gas stream, by means of bypasses controlled by gate valves, is turned into the second chamber. At the same time steam from a steam header is introduced into the first chamber and the adsorbed gasoline distilled from the charcoal.

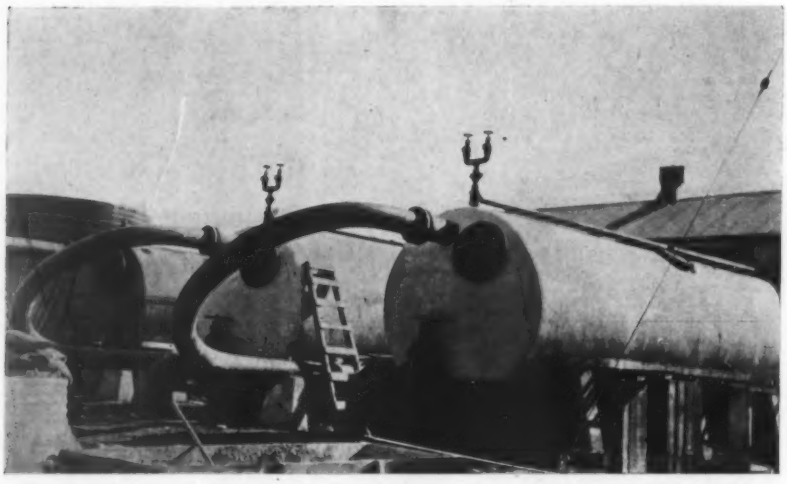
In this way it will be recognized, the charcoal chambers are alternately stills and adsorbers. The charcoal process is not continuous but rather a "batch" process. Operations are carried on in "cycles," a term which designates the period between changeovers from one chamber to another.

Cooling Provided

The third chamber is provided so that the adsorber and its charcoal content which has just been steamed may be



Two Ingersall-Rand gas engine direct driven compressors for special handling of very rich gas from one well



Three 7x30 insulated charcoal absorbing chambers placed in parallel

cooled before fresh gas is again introduced into it.

It has been found that temperature has an appreciable effect on the process of adsorption. In a general way; the lower the temperature, the greater the amount of adsorption.

If the fresh gas was turned directly into the warm chamber after steaming, part of the gasoline content would be unrecovered until the internal temperature had dropped to near that of the entering gas.

As it is, an appreciable amount of undesired heat is liberated when the natural gas is first passed through the fresh charcoal.

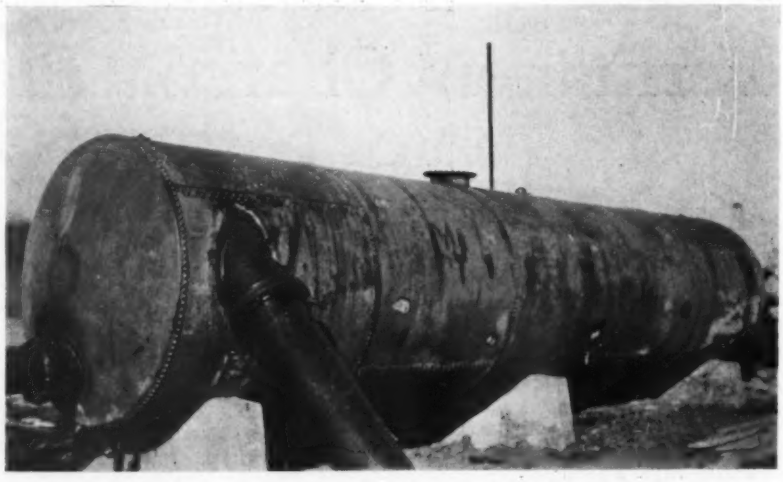
It is probable that the gasoline vapors are condensed on the pore surfaces of the charcoal and held in a liquid state. If the gases are actually condensed it is likely that the heat that is evolved during adsorption in the charcoal chambers will be the heat of liquefaction of the pentane, hexane, heptane, etc., plus the heat given off by the liquid gasoline wetting the charcoal.

Control

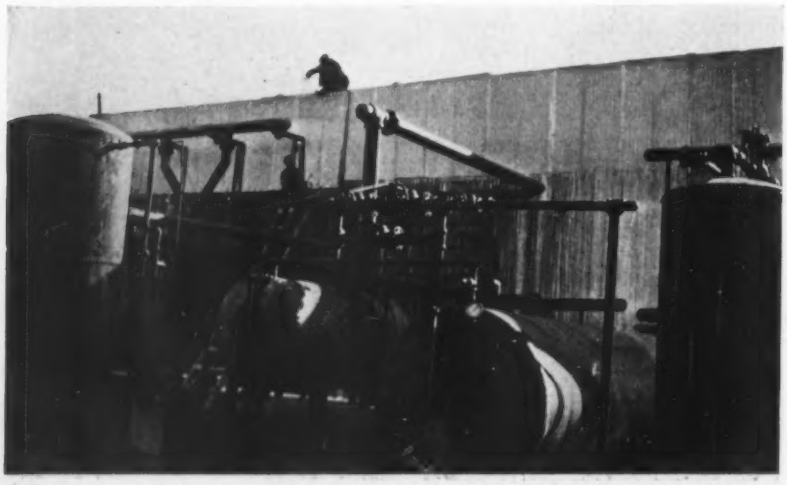
When fresh gas is first passed into the unsaturated charcoal, the heat wave spreads throughout the bed of the charcoal and then drops to near that of the gas coming in. The movement of this wave of heat is the means of control of the charcoal process. A recording thermometer to chart this change is used to follow the process of adsorption.

To secure the most complete extraction of the natural gasoline, however, the cycle must be carried beyond the first point of saturation. It has been found that the shorter the cycle the wilder the gasoline the charcoal will yield. This suggests that the initial rise in temperature is due to the heat evolved during the rapid adsorption of the lighter ethane, propane and butane. Then during the further passage of the gas through the charcoal the gasoline forming constituents (pentane, hexane, heptane, etc.) displace the lighter vapors. pors.

The saturation of the charcoal which will yield the most marketable gasoline is probably just beyond the point where the charcoal is capable of removing all the gasoline vapors possible. The time necessary for this varies with the natural gas being run and the operating conditions, of course.



Scrubber, 10x40 feet, through which gas passes before entering the plant



Water separator chamber, run tank and accumulator. Sheet iron condensor house in background

The steam used for distillation shows about 23 pounds pressure at the steam header, but there is a drop, it is known, as it passes into the charcoal tanks. The steam enters the tank by the way of a slotted pipe running the full length of the chamber at the top. The adsorbed gasoline is, therefore, steamed down. The vapors pass back through the inlet or distributing pipe placed at the bottom which is this time changed over to lead to the cooling coils.

Griscom-Russell heat exchangers are used by the Skelly company. The small size and thin walls of the tubes make them very efficient for charcoal plant installations.

The first set of cooling coils are used as a steam condenser. The liquid and vapors pass from them into a tank where the water is trapped. The remaining vapors are then passed through other cooling coils which condense the gasoline.

Cracking Process Dominate Refinery Improvement Program

By Keith J. Fanshier

IF ONE is to be judge by exterior signs and indications of plant construction activity, the refining branch of the oil industry is at a peak of modernization construction. Never was there a more widespread and extensive improvement and enlargement of plant facilities than at the present time.

This great program of refinery plant extensions and modernization is directly supplementary to the fact that the refining capacity of the country has been increased until it stands in excess of any previous time.

Although important additions to the list of refineries have been made by the construction of complete new plants, it is not so much that phase of the situation which this article will consider as the remarkable phenomenon of widespread enlargement and improvement of plants already in existence.

In the last five years this factor of plant improvemnet has been of much greater numerical importance than new plants constructed. One brief statement, while not comprehensive of all elements in the situation, yet supplies a fair index of this comparison. In the last five years the number of new plants constructed has increased less than twenty per cent. Yet in the same period total refining capacity of the United States has increased at least fifty per cent.

Ratio of Refining Capacity

In round numbers, refinery capacity of the United States today approximates 3,000,000 barrels of crude oil daily. To continue to use round figures, this level of refinery capacity means that the ratio of plant capacity of the United States is to the crude oil production of this country (Jan. 1, 1926) as 3 is to 2, although really the ratio is somewhat larger than those rough figures would indicate. It also appears that refinery capacity now bears to daily petroleum requirements the ratio of 3 to 2. (The figures used in the latter comparison represent the status of the two factors over a period of sufficient time to permit the drawing of intelligent averages.)

This widespread campaign of plant renovation, improvement and enlargement represents something more than an unimportant phase in the history of an industry, or the passing importance of plant improvement to be encountered at random in reviewing the growth and progress of manufacturing processes in any industry. It has a wider significance.

The real significance of the great wave of refinery improvement would seem to be that the present time marks the entrance of the science and art of petroleum refining into a new stage of development. And there would seem to be little difficulty in pointing out what the dominant note or the outstanding characteristic of the new phase is. More and more it is apparent that this age in refining practice is to be dominated, and probably exclusively known, as the cracking age.

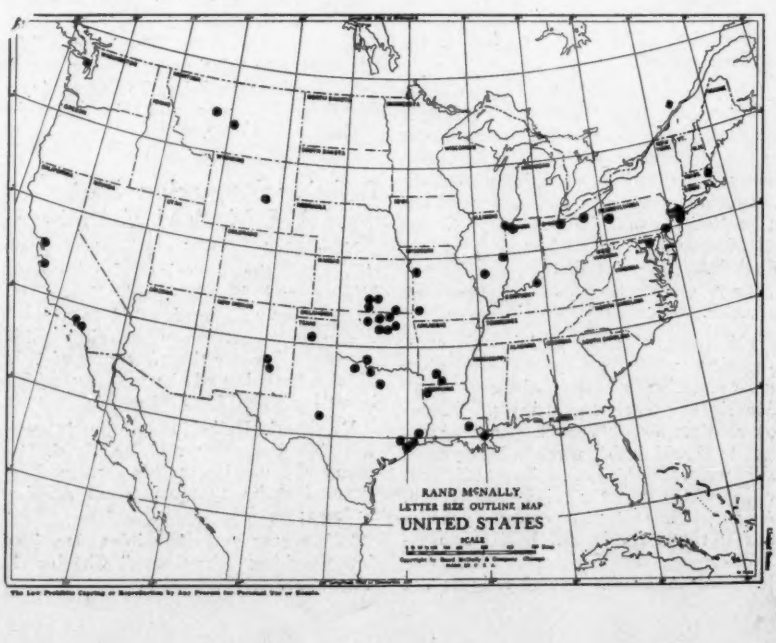
There is nothing particularly new about denominating the new era as the age of cracking. The truth, of course, is that the importance of the cracking process has been growing steadily and surely, but so steadily and so surely that many in the industry failed to get the proper perspective of the actual situation.

Improvement Projects

It is possible to grasp the real facts in connection with the refining cracking situation by considering the facts that grow out of a survey of improvement programs being projected, actually under way or being completed by refining companies, as referred to above. This survey shows that, out of a total of some 590 refining plants in the United States proper as of January 1, 1926, improvement projects were under way at 105 of them, of such extent as to really justify the term, improvement. Of course in a great many more plants than 105 there was improvement work going on, but in that number it constituted sufficient importance and size to be regarded as substantial. Furthermore, at 70 of these 105, the improvements and enlargements had to do with installation, betterment or enlargement of cracking facilities.

Refiners certainly realize that the cracking process development has been wonderfully rapid, but just how rapid it has been, many of them do not realize. Here are pertinent figures. Ten years ago the production of gasoline by cracking was negligible. After 1915, however, swift progress began to be made, so much so that in the year 1920 the production of gasoline by cracking process was about 630,000,000 gallons. Now compare that figure with the total volume of cracked gasoline estimated to have been produced in the United States alone in 1925. The figure is 2,650,000,000 gallons, considerably more than two and one-half billion gallons of gasoline by the cracking process, roughly one-fourth of all gasoline produced in the United States the past year; and much more than one-fourth of all gasoline consumed in the United States during the year.

Predictions in the oil industry invariably are hazardous. Yet it would seem a fair assumption in view of the enlargements now under way that the cracking capacity of the country for



the year 1926 would prove equal to at least one-third the consumption of gasoline in 1926, and quite possibly the actual production of gasoline by cracking will approximate one-third of all gasoline produced. At the close of 1926 the volume of gasoline by cracking was continuing to mount and at that time had reached practically 30 per cent.

Still Growing

The cracking process is proving itself to be literally the newly unchained giant in petroleum refining. It has surpassed expectations not only in the volume of production of gasoline for which it is accounting, but from an economic standpoint. As time passes the limitations of the cracking process, which which have been predicted as near, are not evident. The question as to what is the "saturation point" of the cracking process now seems less competent and less justified than ever before. Predictions were made as recently as five years ago by otherwise and theretofore capable engineer-economists that the somewhat limited range of the cracking process rendered it only a question of a short time unitl cracking would be proved to be not only economically unsound but financially unprofitable. Today such predictions ring false, at least as far as concerns the period of time which can be seen with any degree of definiteness into the future. The cracking process is proving itself a model in versatility, in yield, in value returned for expense incurred, as well as considered from virtually every standpoint in an economic sense.

All this is not to say that the cracking process is a panacea. The writer holds no particular brief for any particular cracking process. But indeed from a study of the situation, one comes to the conclusion that the cracking process in general needs no brief, and is perfectly capable of standing on its own feet and standing or falling on its own records.

The extent to which the cracking process has been developed is borne home more by considering its percentage in the new and improvement work being done rather than in regarding the total volume of gasoline for which it has been responsible in the past. As stated, construction and modernization work being done at all refineries hinges largely on some phase of cracking practice.

The companies engaged in this construction work are quite thoroughly representative of the whole list of American petroleum refiners. Moreover, the districts and geographical points in which this work is being done are widespread, every important division of the country being represented. As yet, it is true, the cracking process has not made effectual initial appearance on the Pacific coast. Nevertheless, in California several refiners are busy with their improvement and modernization programs.

Companies at Work

At present the erection of new refineries is not at a high level. It cannot be said that at any time in the last five years has new refinery construction been very intense from the standpoint of numbers involved. The average number of new refineries built in the last five years has been slightly less than 20 each year. It would seem conservative to believe that the number of new refineries constructed in the next five years probably would not surpass that figure as an annual average. Rather, it seems to be the present trend to enlarge and render more efficient plants already in existence.

Viewing the list of plants which are completing improvements, have improvements under way or are contemplating them with sufficient definiteness for the projects to be regarded as certain, one finds an imposing list of names. In some cases the names of the larger companies involve important plant extensions at more than one refinery. Here is a representative portion:

Several of the Standard companies, including Standard Oil Company of New Jersey and Standard Oil Company of Indiana; Indian Refining Company, Roxana Petroleum Corporation, Champlin Refining Company, Marland Refining Company, Texas Company, Mid-Continent Petroleum Corporation, Gulf Refining Company, Midwest Refining Company, Wilhoit Refining Company, Sinclair Refining Company, Pure Oil Company, Barnsdall Refining Company, Louisville Petroleum Company, British Associated Oil Company, Ltd., Lavery Oil Company, Houston Oil Company, Beacon Oil Company, California Petroleum Corporation, Pan American Western Petroleum Company, Empire Refineries, American Refining Company, Continental Oil Company, Interocean Oil Company, Ohio Oil Company, National Refining Company, Paragon Refining Company, Arro Refining Company and Pennsylvania Refining Company.

Refining Symposium Part Of A. I. M. & M. E. Program

New York.—At the annual meeting this year the American Institute of Mining and Metallurgical Engineers, one session will be devoted to a symposium on petroleum refining. This session will come the afternoon of Feb. 15, the first day of the meeting, which is set for Feb. 15, 16, 17 and 18.

Dr. T. G. Delbridge of the Atlantic Refining Company, and Dr. C. H. Osmond will preside at this session. Program for the symposium on refining follows:

"Character and Principles Involved in Cracking Processes," Charles L. Parmalee.

Discussions:

"Cross Process," Dr. Roy Cross.

"Holmes-Manly Process," C. S. Holmes.

"Jenkins Process," O. C. Smith.

"Dubbs Process," Dr. Gustave Egloff.

"Burton Process," Dr. R. E. Wilson.

"Fleming Process," Dr. R. H. Brownlee.

"Comparative Merits of Cracked Gasoline as a Motor Fuel," Arthur E. Wells.

"Economic Incidence of Cracking," Benjamin Brooks, Roland B. Day and Arthur Knapp.

"Basic Changes in Refining Processes," speaker not selected.

Special discussions:

"Distillation of Pipe Stills," J. Primrose.

"Fractionation," W. A. Peters.

"Treating," not selected.

"Wax Separation," Lee D. Jones.

"Economic Effect of Basic Changes in Refinery Operation," Walter Miller.

"New Gasolines and Anti-Knock Compounds," Dr. Sparrow.

Discussion:

"Economic Effect of the Use of New Gasolines and Anti-Knock Compounds," A. L. Clayden, H. L. Horning.

Foxboro Takes Building For Pittsburgh Branch

The Foxboro Company, Inc., of Foxboro, Mass., makers of indicating, recording and controlling instruments, have announced the change of address of their Pittsburgh office. Formerly located in the Park Building, the company have moved this office to what will now be known as the "Foxboro Building," on the corner of Sixth Avenue and Grant Street. The four upper floors of the building will be utilized for offices and the maintenance of a substantial stock of new instrument equipment, including Flow Meters, Indicating and Recording Gauges and Thermometers and Controllers. The central location of this building should prove of exceptional advantage.

H. S. Gray continues in charge of the company's Pittsburgh branch.

Harlan to Build

The Harlan Oil Company will construct a gasoline plant three miles north of Avant, Okla., in section 25-24-11, which it is planned will be in operation in about two months.

The company is at present making a check on the gas which will be available and the size of the plant will be determined by the data secured in this preliminary survey.

M. Hamada of Nippon, Japan, has returned to the United States and is now located in Los Angeles, where he will establish headquarters for the distribution and sale of a natural gasoline process known as the "Adsole" process.

Making Kerosene Carry Its Own Load

Associated Oil Company has special plant built to fulfill definite method

By Keith J. Fanshier

IS KEROSENE as a petroleum product to be relegated entirely to the dark ages? Has it passed into a decadence of such an extreme nature that the American petroleum refiner looks eagerly forward to the time when the advance of refining practice will remove kerosene from a place in his ken?

Judging from the policies of many concerns in the business, this is not an unusual attitude among refiners. In many cases kerosene is being endured as a necessary evil, regarded as a product the days of which are numbered, a thing to be endured only sufficiently long to assist it to come to the end of its days in service to the public and in the sphere of the refining industry.

That widespread attitude toward the whole subject of kerosene makes all the more interesting an exception to the rule. One of the notable exceptions is furnished by one of the large western refiners who decided that under certain circumstances it would be profitable not to float downstream with the current and with associates, as the old copy-book maxim had it, but to turn and fight the current, oppose common practice and cut into and enlarge a business and demand overlooked or at least not appreciated to its full potentialities by many others.

Research First

Here then is a brief recital of what the Associated Oil Company has been doing with kerosene, and what kerosene has been doing for the Associated Oil Company.

For a long time engineers of the Associated Oil Company were dissatisfied with the results the company obtained in kerosene output. This was the state of things about ten years ago, when the Associated engineers and officials had brought to their attention the work being done by Dr. L. Edeleanu, a widely known Roumanian chemist who had for years conducted research work in the field of petroleum, and had given special attention to the refining of kerosene. Investigations and experimental work of the Associated engineers with Dr. Edeleanu had just started when the entrance of the United States into the World War forced discontinuance of work. The subject had not been forgotten, however, and at the signing of the armistice, investigation was re-opened. There followed several years of detailed experimental work and study. In the end, the result was the erection by Associated of a refining plant, especially for the recovery of kerosene under the methods worked out primarily by the Roumanian scientist and supported by work of the company's engineers. Today the plant, with improvements, represents an investment estimated at $500,000.

The Old Way

Prior to the utilization of the Edeleanu process, according to the Associated authorities, kerosene made from California crudes was refined principally by mixing the raw kerosene stock with sulphuric acid at relatively high temperatures, as a primary step. There followed the washing process. Then came a further treatment in which sodium hydroxide was the re-agent used. The finishing process was the washing with water. This process was based on the effect, which was actually realized, of removing from the fluid certain sulphurous, naphthenic and aromatic compounds. It is stated that this treatment, considered as a whole, removed undesirable compounds amounting to perhaps 25 per cent of the total volume of the oil. After this preliminary process had been undergone, the fluid was again subjected to an acid and lye treatment not dissimilar to the original treatment, with consequent loss of a certain amount of material.

It was the contention of the sponsors of the new process that the expense of this kind of treatment was too high because of the large losses involved and because they were convinced these expenses could be diminished. The large quantities of sulphuric acid and caustic necessary to remove the injurious compounds were examples of the unnecessary expense, it was held, as well as the comparatively large losses of the oil which were occasioned. As contrasted with the formerly used method, it was demonstrated that the new process, employing liquid sulphur dioxide, eliminated and made unnecessary the washings, re-washings and redistillations.

The New Way

In brief, it may be said that the new process used by the Associated in refining is quite a marked digression from the previous methods. Under the new process, sulphur dioxide gas is compressed to a liquid state at or very near what constitutes a freezing temperature. The kerosene is mixed with the liquid sulphur dioxide under considerable pressure. Mixing is accomplished by a system of agitation of such a thorough nature as to leave no question of the absolute quality of the mixture. When the mixing has been completed by the carrying on of this operation to a certain point, the pressure is released. The result is that impurities which, according to Associated engineers, hitherto had absolutely defied refining methods can be and are separated from the kerosene stock proper and are thereupon drawn off.

Subsequently, the sulphur dioxide which has been used to such good effect returns to a gas and is pumped back to its original place in compression tanks, where it is again liquefied and is once more ready to take its part in this system of refining kerosene. This, according to the Associated engineers, not only sounds surprisingly simple but it is as simple as it sounds.

Bad Odor Gone

For the kerosene which has been refined by the Edeleanu process described above, it is claimed that the product is now practically free from the characteristic disagreeable smell noticeable in kerosene. The odor of the Associated kerosene refined under the process is described as being quite sweet, having virtually the odor of alcohol.

The Associated Oil Company was not content to produce this grade of kerosene and let it go at that, without "following through" and experimenting with the product after it was manufactured, believing that in such research work there are manufacturing pointers to be learned just as well as in the actual refining process—a line of thinking, by the way, apparently not appreciated by manufacturers in general, even by some petroleum refiners, it appears.

At any rate, the Associated Oil Company is doing some interesting experimental and research work with this new kerosene. A series of rigid tests for the product have been devised which have been of value because of guidance in the manufacture of the products, throwing a light as it were on the workings of the product as well as permitting the company's experimenters to come into the same position as the users of the kerosene.

The Lamp Test

Thus it comes about that one of the

most important guides to the Associated Oil Company in the manufacture and refining of kerosene is the oil lamp itself, lowly object though it be. The lamp test is regarded as the most important and crucial which the kerosene in question must pass. In describing this test, it may be said that a standard kerosene lamp is used, filled with the kerosene, and the flame of the lamp turned down to such a low point that it can be only barely discerned above the guard. The lamp then must burn for at least seventy-two hours on this low wick—a severe test, admittedly. This is a test of an unusual nature for the reason that the heat of such a radically reduced flame fails to generate much of a draft through the chimney, or speaking comparatively, creates almost no draft at all. The more complete combustion naturally could be expected where the greatest volumes of oxygen were admitted to the presence of flame, and under such circumstances naturally the deposit of soot could be expected to be in inverse proportion to the amount of air admitted, other factors being equal. Consequently, with a much reduced amount of air coming in contact with the flame, the chances are much greater for an accumulation of soot on lamp chimneys, to say nothing of the disagreeable odor due to partially consumed kerosene, with which almost anyone who has lived on a farm or in very small towns in certain regions of the country is familiar. It is the pride of the Associated organization that the kerosene from this process is able to pull through such an exacting test favorably. It is considered a remarkable tribute to the cleanliness of the product that this is true.

Low Cost

At the end of the three-day, low-burning lamp wick test, the lamp chimney is removed and is carefully examined for traces of soot, carbon or other impurities which ordinarily could be expected to condense on lamp chimneys when the wick is turned low. This, as above stated, serves as a clear guide to the quality of the kerosene being produced by the plant at any particular time and is a very good check on the activities of the plant, the engineers consider.

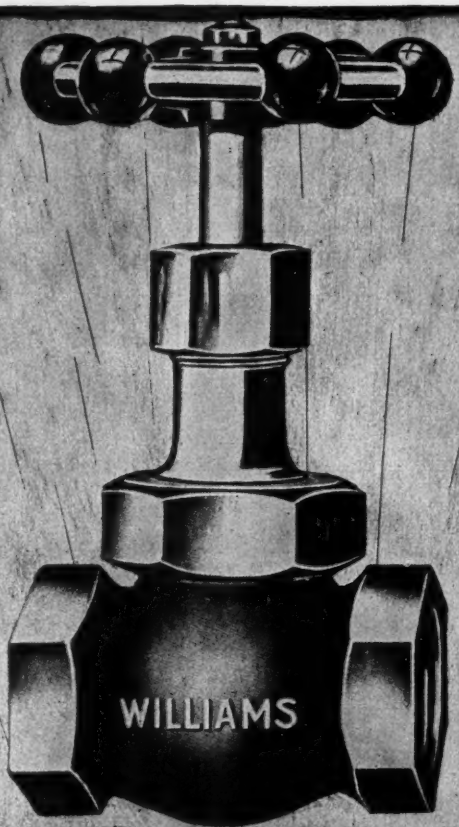
The lamp test also includes a phase of burning hinging on the turning of the wick to an extremely high point, in direct contrast with the low-burning wick.

The Associated organization believes that it was the first refiner of petroleum products to install a process giving a kerosene so remarkably free from the many mischief-makers which have clouded lamp-chimneys and cause wicks to become dirty, sticky, gummy, and of foul odor. In addition to the fact that the product is of this high grade, Associated is gratified over its kerosene department because of the comparatively low cost involved in the kerosene refining process, due to saving of time, conservation of treating material and preventing waste of oil.

Natural Gasoline Manufacturers at Los Angeles Gather

Following are those attending the meeting of natural gasoline manufacturers held in connection with the Annual Meeting of the American Petroleum Institute

Name, Company	Address
W. C. Dayhutt, Standard Oil Co.	Whittier, Calif.
R. E. Wells, Jr., Reservoir Hill Gasoline Co.	Long Beach, Calif.
E. L. Tobias, General Petroleum Corp.,	Los Angeles
Ivan E. Goodner, Consult. Eng., Western Oil Refining Company	Los Angeles
M. D. Schatzman, V. P., West Coast Refining Co.	Los Angeles
J. S. Grepe, Jr., Standard Oil Co.	Montebello, Calif.
R. E. Beckley, Pacific Gasoline Co.	Los Angeles
H. P. Cummins, Standard Oil Co.	Montebello, Calif.
H. L. Eggleston, Pan American Petroleum Co.	Los Angeles
J. Stuart Watson, Shell Co. of California, Gas and Gasoline Dept.	Wilmington, Calif.
Paul D. Barton, The United Oil Co., Gas Dept.	Los Angeles
Claude C. Brown, California Railroad Commission	Los Angeles
Vladimir Kalichevsky, Union Oil Co.	Los Angeles
T. R. Beauchamp, California Gasoline Corp.	Los Angeles
H. W. Parmelee, California Gasoline Corp.	Los Angeles
E. E. Dorresten, C. F. Braun & Co.	Alhambra, Calif.
J. C. Burks, Gilmore Oil Co.	Los Angeles
D. B. Johns, Standard Oil Co.	La Habra, Calif.
Donald E. Silcox, Standard Oil Co.	Whittier, Calif.
E. H. Pann, Pan Amer. Pet. Co.	Torrance, Calif.
F. A. E. Lowell, Pan American Pet. Co.	San Pedro, Calif.
F. S. Wade, Lomita Gasoline Co.	Long Beach, Calif.
J. A. Campbell, Lomita Gasoline Co.	Long Beach, Calif.
C. La V. Larzelere, Atty., California Gasoline Corp.	Los Angeles
C. E. Gotterba, Richfield Oil Co.	Huntington Beach, Calif.
F. E. Keith, The Corporation Co.	Claremore, Okla.
J. L. Castor, Surety Gasoline Co.	Los Angeles
Edwin K. Chase, Southwestern Eng. Corp.	Los Angeles
Ervin E. Rollins, Pacific Gasoline Co.	Taft, Calif.
E. P. Turner, Pacific Gasoline Co.	Taft, Calif.
L. R. McMaster, Standard Oil Co., Prod. Dept.	Inglewood, Calif.
B. F. Masten Chief Eng., Pacific Gasoline Co.	Taft, Calif.
Hugh B. Evans, Jr., V. P., Hugh B. Evans, Inc.	Los Angeles, Calif.
W. M. Schaufelberger, Pacific Gasoline Co.	Taft, Calif.
E. A. Hanger, Signal Gasoline Co., Inc.	Los Angeles, Calif.
Chas. T. Reichert, Calif. National Supply Co.	Los Angeles, Calif.
C. D. Gard, Union Oil of Calif.	Los Angeles, Calif.
R. A. W. Bultmann, Union Oil Co. of Calif.	Los Angeles, Calif.
H. C. Marshall, Union Oil Co. of Calif., Gas Dept.	Los Angeles
C. F. Hansen, Standard Oil Co.	El Segundo, Calif.
C. W. Rehfuss, Standard Oil Co.	El Segundo, Calif.
W. H. Hales, Standard Oil Co.	El Segundo, Calif.
P. S. Williams, Standard Oil Co.	San Francisco, Calif.
Ronald D. Gibbs, Union Oil Co. of Calif.	Los Angeles, Calif.
Wm. H. Wachtel, Standard Oil Co., Casinghead Gasoline Department	Los Angeles, Calif.
G. G. Oberfell, Phillips Pet. Co.	Bartlesville, Okla.
H. B. Bernard, Sinclair	Tulsa, Okla.
A. H. Bradford, West Coast Ref. Co.	Los Angeles, Calif.
Wm. A. Kirk, Export Ref. Corp.	Los Angeles, Calif.
C. J. Von Bibra, Export Ref. Corp.	Los Angeles, Calif.
Harry V. Welch, 1016 W. 9th St.	Los Angeles, Calif.
C. W. Barden, B & B Pipe Shops Corp.	Los Angeles, Calif.
Edward R. Bailey, Nat. Airoil Burner Co.	Philadelphia, Pa.
Herley, Jack, Herley Pipe & Supply Co.	Los Angeles, Calif.
Harold E. Moulton, Chanslor-Canfield Midway Oil Company	Torrance, Calif.
George L. Tyler, Pacific Gasoline Co.	Los Angeles, Calif.
S. B. Mosher, President, Signal Gasoline Corp.	Los Angeles, Calif.
R. H. Green, Field Mgr., Signal Gasoline Co., Inc.	Los Angeles
G. L. Young, Signal Gasoline Co., Inc.	Los Angeles, Calif.
C. E. Roth, Roth & Faurot	Independence, Kans.
M. E. Garrison, Pan American Pet. Co.	Los Angeles, Calif.
S. E. Merenbach, Consulting Engineer	San Francisco, Calif.
J. W. Reed, C. & G. Cooper Co.	Los Angeles, Calif.
E. E. Plumly, Magnolia Pet. Co.	Beaumont, Texas
A. R. Tatnall, Standard Oil Co.	Torrance, Calif.
A. G. Meakin, Union Oil Co.	Long Beach, Calif.
W. F. Cerini, Union Oil Co.	Walnut Park, Calif.
Alfred J. Barnewolt, Standard Oil Co., Prod. Dept.	Whittier, Calif.
R. E. Cameron, Pacific Gasoline Co.	Taft, Calif.
C. L. Ross, Pacific Gasoline Co.	Taft, Calif.
Paul F. Ginter, Standard Oil Co.	Los Angeles, Calif.
W. L. Cowger, Pacific Gasoline Co.	Taft, Calif.
W. M. Wolfe, C. O. Co., Csghd. Gas Dept.	Whittier, Calif.
A. M. Ballard, Sun Oil Co.	Tulsa, Okla.
Ira G. Wetherill, National Supply Co.	Independence, Kans.
F. W Crell, Eng., Union Oil Co.	Los Angeles
Nathan H. Stidyet, California Gasoline Corp.	Long Beach
E. H. Mathis, Producers Gasoline Corp., Long Beach Gaso. & Ref. Co.	
C. B. Edington, Signal Gasoline Co.	Los Angeles
C. B. Edington, Signal Gasoline Co., and Rex Gasoline Company	Los Angeles
Francis E. Wilkinson, Newton Process Co.	Los Angeles
I. B. Funk, Union Oil Co. of California	Los Angeles
A. E. Murphy, Pacific Gasoline Co.	Los Angeles
K. L. Reynolds, Pacific Gasoline Co.	Los Angeles
Harry J. Bauer, Pacific Gasoline Co.	Los Angeles
P. L. Marston	Huntington Beach, Calif.
C. F. Story, Standard Oil Co.	Huntington Beach, Calif.
J. R. Grizzle, Pacific Nat. Gasoline Co.	Long Beach
H. J. Ratti, Gasoline Recovery Corp.	Charleston, W. Va.
L. B. Riddle, Shaffer Oil & Ref. Co.	Tulsa, Okla.
H. A. Bardeen, Bardeen Oil Co.	Los Angeles
T. K. Sloan, Pacific Gasoline Co.	Taft, Calif.
H. L. McCarty, Union Oil Co., Gas Dept.	Los Angeles
W. L. Stewart, Jr., Union Oil Co. of Calif.	Los Angeles
Geo. L. Ratcliffe, General Petroleum Corp.	Los Angeles
H. J. Maxwell, Pacific Gasoline Co.	Los Angeles
H. M. Stalcup, Skelly Oil Co.	Tulsa, Okla.
R. W. Garman, Union Oil Co. of Calif.	Los Angeles
Edw. B. Gogertx, Columbian Steel Tank Co.	Kansas City, Mo.
J. B. Arthur, Union Oil Co. of Calif.	Los Angeles
J. C. Rector, Union Oil Co. of Calif.	Los Angeles
A. E. Smithers, Standard Oil Co.	Los Angeles
R. L. Magee, Torrance Gas & Ref. Co.	Los Angeles
J. F. Vordermark, Olinda Gasoline Co., and Torrance Gas & Ref. Co.	Los Angeles
F. M. Petner, Union Oil Co.	Los Angeles
D. R. Van Gorder, Torrance Gaso. & Ref. Co.	Torrance, Calif.
Grover S. Harvie, Olinda Gasoline Co.	Placentia, Calif.
Davis A. Duncan, Reservoir Hill Gaso. Co.	Long Beach
F. L. Chase, Lone Star Gas Co.	Dallas, Texas
K. G. Steinbeck, O. C. Field Gaso. Corp.	Huntington Beach, Calif.
O. C. Field, O. C. Field Gaso. Corp.	Los Angeles
R. J. Behan, General Pet. Corp.	Los Angeles
T. T. Rissinger, Union Oil Co., Gas Dept.	Los Angeles
M. R. Cowan	Los Angeles
F. E. Bradley, Chanslor-Canfield-Midway Oil Co.	Torrance, Calif.
A. F. White, Brea Canon Oil Co.	Los Angeles
H. G. Stearns, Brea Canon Oil Co.	Los Angeles
E. H. Jones, Union Oil Co. of Calif.	Los Angeles
F. R. Coates, Cities Service Co.	New York
W. H. Rogers, California Gasoline Corp.	Long Beach



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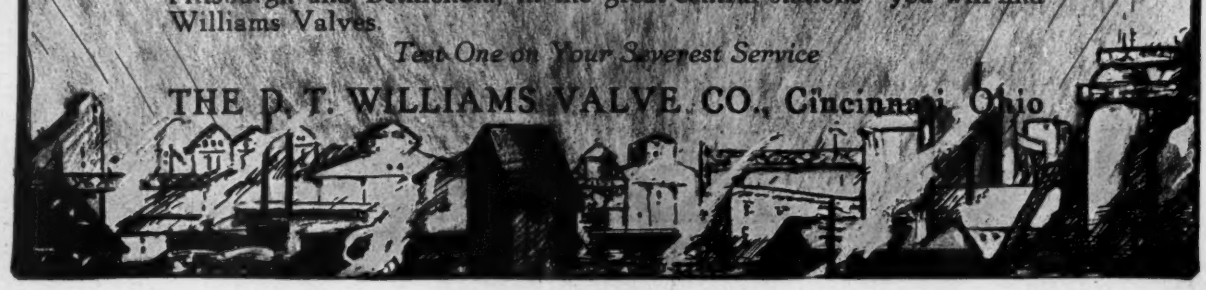

Mineral Oil Distillation With Large Evaporating Surface

By Ismar Ginsberg

IN the distillation of mineral oils there is always present the danger that the oil will be decomposed during the distilling process, which is of course undesirable except under certain special conditions. The decomposition of the oil in the course of its distillation is due to various factors, such as the height of the temperature during the process, the rate at which the distillation is conducted, which when slow induces decomposition, and then particularly the contact that is made between the oil and the highly heated walls of the still.

Hence in general there have been two ways devised in which to get around this difficulty. In the first place there is the method which makes use of a vacuum in the distillation process and which naturally has the effect of reducing the temperature at which distillation occurs. High vacuum installations are interesting and the results that have been obtained with them are highly satisfactory. In a former article which appeared in The Refiner and Natural Gasoline Manufacturer, the author discussed the results obtained with high vacuum installations.

The second method is an entirely different one and consists in substituting for boiling of the oil in the still the process of evaporation. This method is based on the observation that evaporation takes place only on the surface and with increasing intensity at any temperature. Hence it follows that when the evaporating surface is large enough in the still, it is possible to carry out the distillation at a low temperature. Thus the same advantages are realized in this method from a thermal standpoint that have been obtained only in the distillation of mineral oils with the aid of superheated steam. It must be pointed out that in the steam distillation the enlargement of the evaporating surface is effected by the mass of steam itself.

Vapor Method

Other methods have been proposed for the same purpose. Thus a series of tests have been made to replace steam with benzine vapors, but these were not successful for it is known that the speed of the evaporation is inversely proportional to the density of the evaporating medium. However the tests have shown that when benzine vapors were used the evaporating surface was better used than in the case of steam distillation. For it was found that it was possible to evaporate heavy oils with the use of sixty per cent of benzine vapors while the steam consumption amounted to 100 per cent. The method which is known as the Ragosin method has not been used to any degree in practical operations.

It must be remembered in trying to avoid decomposition of the oils during distillation that after all the main factor that brings this about is the contact of the oil with the highly heated surfaces.

One method which has appeared to be worth while giving serious attention to is the process invented by Professor J. Mosicicki, which is described in Petroleum Zeitschrift, 1925, pages 641 ff., from which we have taken certain of the information which is given in this article. The basis of the method is the evaporation of crude oil on large surfaces in a stream of superheated benzine vapor. The latter forms the heating medium. Hence there are obtained both evaporation at large surfaces and a high rate of evaporation, and also thorough internal heating of the oil. This results in a uniform distribution of the heat throughout the mass of petroleum, all of which are conditions which are very favorable to the prevention of the decomposition of the petroleum hydrocarbons. It has been therefore claimed that the distillates and particularly the lubricating oil, that are obtained in this manner, have very favorable properties, such as high viscosity and flame temperature. Furthermore such distillates are then easily refined.

The process appeared important enough to be subjected to a laboratory test to determine the practicability of distilling oils in a constant stream in large scale operations and the quality of the products that are obtained in this manner. Instead of using crude oils in this process various residuals, containing paraffine were employed so as to obtain a heavy lubricating oil.

Laboratory Test

The laboratory apparatus consisted of a small still, a superheater for production and superheating of the benzine vapors which was employed in the still as the heating medium. Two columns were also used, which were filled with suitable packing, one being employed as an evaporator and the other as a condenser. A water cooler for the distillation of the benzine vapors and the necessary piping completes the installation.

The method that was employed in carrying out these tests was as follows: First the entire apparatus was heated up to the proper temperature and they were allowed to enter the first column through the bottom. The vapors passed through both columns from the bottom upward and were then condensed in the water cooled condenser and finally returned to the still. In this manner a current of benzine vapors was made to pass through the entire apparatus. Then when the temperature within the apparatus had attained a definite constant point for some time, the mixture which was to be distilled was allowed to enter the first distilling column. This column was provided with a series of plates which divided it into compartments and also had the effect of retarding the passage of the oil through it so that a complete admixture with the benzine vapors could be secured. The oil flowed down the column slowly, spilling over from one plate to the next below it with the result that it was slowly vaporized and the distillation residue was removed continuously from the bottom of the first distillation column. The mixture of oil vapors and benzine vapors passed out of the column at the top and then was made to enter the bottom of the second column where it was condensed and collected at the bottom. The benzine vapors did not however condense as the temperature was too high in the column, but were allowed to escape through the top and were eventually condensed in the water-cooled condenser. They were then returned to the benzine still and used over again in the process.

Commercial Possibilities

Of course as might have been expected in carrying out the process it was not possible to secure sharp separation between the vapors of oil and the benzine vapors as the oil vapors were not completely condensed in the second column but were finally found in the benzine still along with the benzine. Then again small amounts of benzine were found in the heavy oil fractions that condensed in the air condenser. However when the oil is subjected thereafter to a brief vaporization the small amount of benzine contained in it is driven off.

The distillation residues obtained in this process were collected and subjected to repeated distillations at higher temperatures according to the same process, and each time a higher boiling point fraction was obtained and a more viscous residual mass, until finally an asphaltic substance was left behind.

A careful study of the method as it was carried out in the laboratory has led the investigators to conclude that

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TYPE	Usual Form with Thermometer.
LENGTH	Approximately 15 Inches
BALLAST	Shot Filled.
CALIBRATION	60 Degrees Fahrenheit.
SCALE	Graduated in 1/10° A. P. I. Thermometer and Correction Scale.
RANGE	Twelve Degrees A.P.I. Standard Ranges Indicated under 0840.
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0852	Specifications
TYPE	Short Form without Thermometer.
LENGTH	Approximately 6 Inches.
BALLAST	Mercury Filled.
CALIBRATION	60 Degrees Fahrenheit.
SCALE	Graduated in 1/4° A.P.I.
RANGE	Twelve Degrees A.P.I. Standard Ranges Indicated under 0840.
PRICE, EACH	$2.25.

0872	Specifications
TYPE	Short Form with Thermometer.
LENGTH	Approximately 6 Inches.
BALLAST	Shot Filled.
CALIBRATION	60 Degrees Fahrenheit.
SCALE	Graduated in 1/4° A.P.I.
RANGE	Twelve degrees, A.P.I. Standard Ranges Indicated under 0840.
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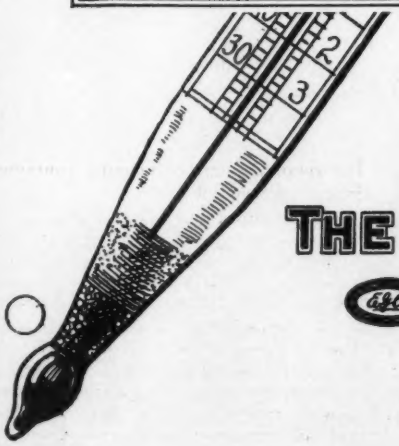

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it possesses all the earmarks of a successful commercial process. Furthermore, the investigators did not work with a crude oil, but with distillation residuals obtained from another distillation, and it is true that the difficulties encountered in this case would not be as great as those which would normally be found in the distillation of crude oil.

One feature of the method that deserves mentioning is the substitution of distillation for fractional condensation. There is a certain definite connection between the vaporization of the oil at large surface areas and the fractional condensation, for it is true that the errors that have been made in effecting the fractional condensation part of the process have brought into disrepute the process of evaporation at large surfaces. However the experiments that the aforementioned investigators have made on this subject have led them to conclude that without abandoning the fractional condensation process in its entirety, good results were obtained with the evaporation at large surface process, at least when distillation residuals are used as the raw materials in the process.

Distillation Speed

In the original article a great deal of detail is given on the results obtained and the observations made during the series of experiments. These results are published in the form of comprehensive tables which cover every feature of the process, such as the composition of the original material, the time of distillation, the temperature, the rate of flow of material through the apparatus, the number of distillations carried out on the residuals, etc., etc.

The speed of the distillation varied between 825 and 2100 grams per hour. The rate at which the benzine vapors were permitted to flow through the apparatus was regulated in such a manner that as far as possible the carrying away of particles of the distilled product by the benzine vapors in mechanical suspension is avoided. The amount of steam that it was necessary to use in the process was approximately the same in all the experiments and was about 7400 grams per hour. The quantity of benzine vapors that is required to effect the distillation of one kilogram of the oil is a figure that is of highest importance in this process. The question is not so much the exact quantity of benzine vapor, for the benzine vapors are made to circulate in an enclosed system and there is comparatively little loss outside of what is carried along by the distillates. It was rather a problem in which the quantity of heat that is absorbed by the benzine and later given up by it to the distilling oil is concerned. A thermal calculation

Number Three—The High Stage Circuit

By Otto Peters

WE study this circuit from the low stage accumulator tank to the intake of the high stage compressor, through the compressor to the cooling coils, through the cooling coils to the high stage accumulator tank.

Condensation may take place in the line from the accumulator tank to the compressor. This should be guarded against as gasoline in the compressor cylinder would interfere with lubrication. The high stage compressor intake pressure would be the same as the low stage compressor discharge pressure, and in general practice the high stage discharge pressure is at 250 pounds so that due to this higher pressure the lighter hydrocarbons are condensed. The discharge temperature would be the same as the discharge temperature of the low stage compressor, but the temperature of the intake gas is one factor that governs the discharge temperature of compressors.

On the high stage compressor we must exercise the same careful forethought regarding its mechanical details as outlined in circuit No. 2 for the low stage compressor, because the efficiency of the high stage compressor affects the discharge pressure of the low stage compressor. In other words, where the low stage compressor takes the gas from the field, the high stage compressor takes it from the low stage and it follows that the temperatures and the pressures are indications of how well they do their work. A practical way of testing a compressor for its cylinder condition would be to connect a mano-meter between the intake gate and the compressor, if no gauge connection is handy it can be connected to the lubricating oil inlet on the compressor, then by closing the intake gate, the amount of vacuum indicated on the manometer would show any leakage past the piston or valves because the nearer to perfect vacuum the better the compressor condition.

ONLY DIFFERENT

In this description, Otto Peters seems to be driving home the fact that the high stage circuit at a natural gasoline plant is just like the low stage circuit, only different.

Each consists of pipe, tanks, compressors, engines and the like. Each produces gasoline.

But the pressures are not equal. Therein lies the chief difference.

And being different, the high stage circuit and its equipment deserves different treatment from installation to maintenance.

And the plant operator who will learn what different treatment the one circuit deserves from the other, has made a long step toward holding his job properly.—The Editor.

In piping this circuit, starting with the discharge line from the compressor, through the cooling coils to the accumulator tank, we enter into higher pressure than in circuit No. 2. This calls for heavier fittings and equipment, and in the cooling coils we now understand the difference between butt weld and lap weld pipe, just look into it and you will see the difference in their pressure rating. Note particularly that the cooling coil inlet header is at the top and the outlet header is at the bottom, there is a reason for this the same as the discharge of the compressor is at the bottom and the intake is at the top, and of course we must not overlook the safety valve and the oil trap in this part of the circuit.

The high stage accumulator tank serves the same purpose as the low stage accumulator tank only it is subject to higher pressure, it too needs safety valve, water drain, gasoline outlet, etc. In practice we find that the most troublesome thing about an accumulator tank is the corrosion which takes place at the water drain connection. When leakage takes place at this connection it should be repaired immediately. We finish this circuit at the accumulator tank, and where there is much in common with this circuit and circuit No. 2 we must observe its detail, be not unmindful of the small ones, only a few years ago I found a man piping a gasoline trap of high stage accumulator tank with electric wiring conduit; I cite this to illustrate the point.

There is much to be thought of in any circuit, and now that we have directed our thought through three of the six circuits in the plant, let us check back and think of what has happened to the gas from the well. We also have in mind it took ages upon ages to form the gas, a few days to drill the well, a few minutes to extract the gasoline. We plant operators are engaged in a wonderful business. You owe it to yourself to study the plant circuits, and where present day practice has practically done away with high stage compression, there still is no harm in reviewing the high stage circuit, because by understanding it well we can better grasp the idea of present day practice and appreciate more the reduced hazards of gasoline plant operation.

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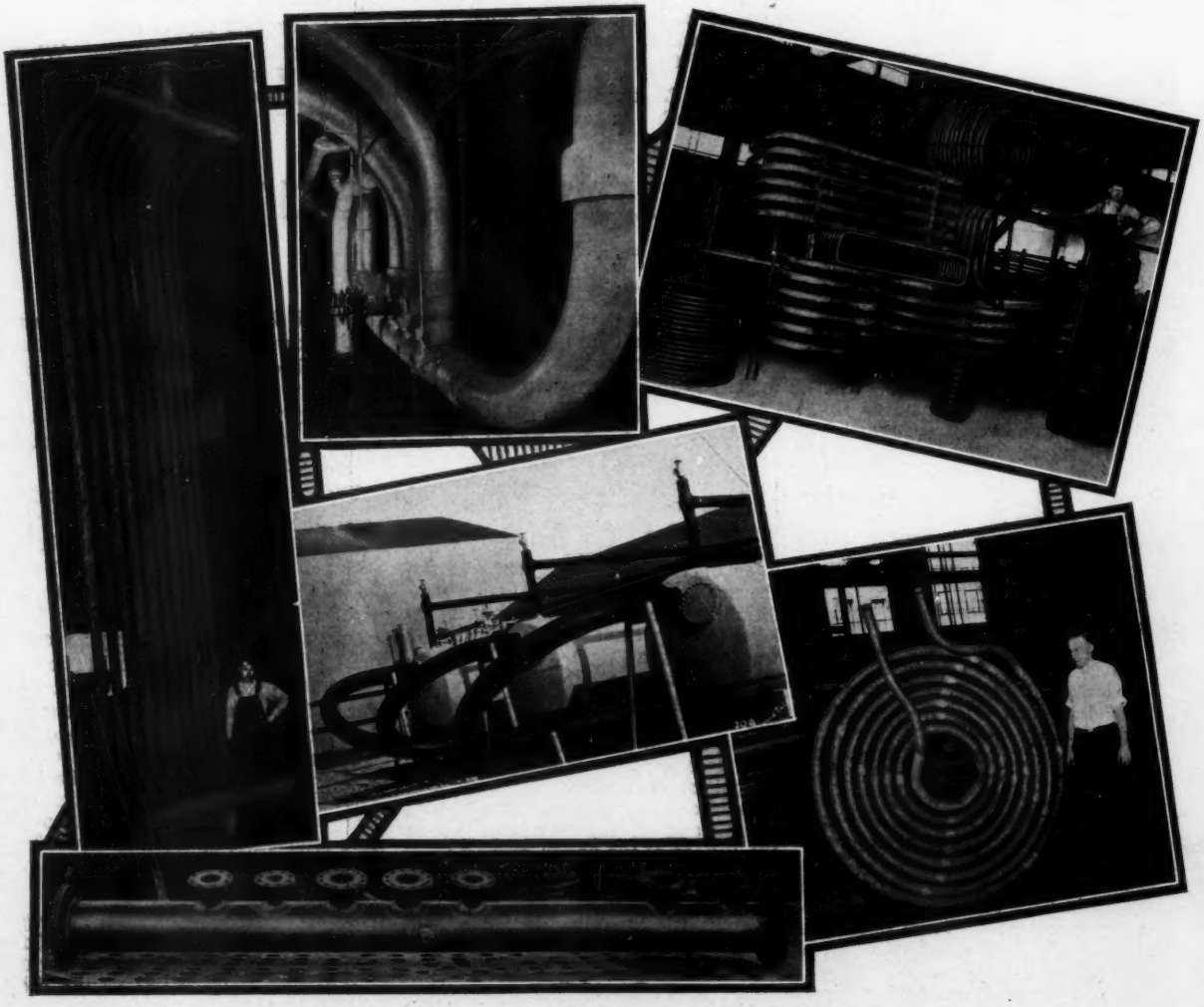

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showed that this quantity of heat was almost four times actually 3.7 times, what is required theroretically, which indicates an efficiency of approximately 27 to 28 per cent. It must however be remembered that these figures cannot be applied without change to large scale apparatus for it is a fact that thermal efficiency is a factor that depends to a large extent on the character of the distilling and heating apparatus, the care with which heat losses are avoided by proper insulation of the operating parts of the apparatus and the provision that is made for the recovery and utilization of part of the waste heat. Furthermore in this particular process the rate of flow of the current of benzine vapors through the apparatus and the character of the evaporating surfaces are also of moment in determining thermal efficiency.

Temperature Evaporation

The temperature that is maintained within the apparatus will of course vary in accordance with the distilling points of the various oils and oil residues that are processed, for the benzine vapors can be superheated to any desirable temperature. Of course it is necessary to see that the temperature of superheating does not exceed the point at which the benzine starts to decompose for then the process would become inoperable. Furthermore the temperature maintained in the process has a very potent effect on the distillation results and in the original German article mentioned above results are given to show what connection this factor has with other variables in the process.

Thus it is at once evident that the quantity of distillate obtained within any period of time will depend on the manner in which the process is being operated. It was found that this process resulted in distillates of very high quality and in the experiments, referred to above, it was seen that even the most viscous starting materials gave oil distillates which were comparatively light in color, varying from a fine violet to a dark green, and being transparent in thin sheets. They were almost odorless, possessed good viscosities and flame temperatures, and had all the properties of the fine grades of lubricating oils of American manufacture and of those which are obtained directly from the distillation of crude oil.

It was also found that the distillates thus obtained could be very readily refined and for this purpose activated carbon, and various other decolorizing and absorptive powders were employed with success. Treatment with four per cent of sulphuric acid resulted in a product which was a light yellow in color and transparent.

Lubricating Oils

Various other tests were made in this investigation, as required in the original article, for the purpose of comparing the results obtained by this process with those secured in high vacuum distillation processes. It was found that the lubricating oil obtained by the benzine process from oil residuals possessed a higher flame temperature and a higher viscosity.

In conclusion it must be said that it has been demonstrated by these investigators that it is commercially practical to use the benzine vapor distillation process to obtain lubricating oils of high quality from crude oil and oil residuals and continue the distillation until a solid residue, either paraffine or asphalt, is obtained in the still. In this manner very viscous, high flame temperature oils are obtained of the highest quality. Of course it is necessary in carrying out this process that the proper conditions of temperature and the like be maintained, so that the benzine is not decomposed during the operation and as complete as possible a separation of the distillation products and the benzine vapors be effected in the operation of the process. When carried out in the proper manner the benzine vapor large evaporating surface process is a success.

When Your Engine's Heart Stops

By Ray E. Day
Secretary Magneto Ignition Corporation

GAS engines are similiar in some respects to the human system and like the human system they must be given reasonable care and attention or they will become of little value or no value at all.

The mixing chamber or carburetor of a gas engine may be likened to the lungs in a human. Oil to the engine is as fats to the human system. The water circulation system may be compared to the blood in the human body which keeps the body at the right temperature to allow proper functioning of all parts.

The most vital organ in the human system is the heart, so we liken this to the most vital part of the gas engine—the ignition unit or magneto.

A man with a weak heart is a poor insurance risk as he might "stop living" at any moment. A gas engine with a weak magneto is a poor "assurance risk" as it might go dead at any moment and put the engine out of commission.

Usually the first symptom of a weak magneto is hard starting or if it develops a weakness while in operation it shows up by cutting out when more load is put on the engine.

When either of these signs are noticed it is advisable to shut down at the earliest possible time and change magnetos. You can then take time enough to try and determine just what the fault is with the magneto removed.

First Step

The circuit breaker points should be examined first as it quite frequently happens that over lubrication of the magneto has caused an accumulation of oil on the surface of the platinum points which of course will not allow a clean contact and consequently causes the magneto to misfire. This oil condition in the breaker box will cause hard starting even though the engine were running all right when shut down. This is because while the magneto is in operation there is sufficient heat at the breaker points to keep the oil at a temperature that will cause most of it at least, to run or drop off the breaker points, but when the engine is stopped and the magneto becomes cool, the oil and oil vapors will collect on the surface of the points, coating them to the point of almost perfect insulation. In starting then it is necessary to turn the magneto shaft until the points have "hammered" through the coating of oil.

Second Step

If upon examination the circuit breaker is found free from oil and perfectly clean the next step is to see that all circuit connections on the magneto are clean and tight. After this you are ready to make the final test to see if the "heart" of the engine has really played out.

Fasten a wire to the high tension plug in the case of a single cylinder magneto (or wires to the distributor block if more than one cylinder) and hold the end of the wire about three-eighths of an inch away from the base of magneto and turn the magneto shaft quickly by hand. This should produce a hot snappy spark. If the spark produced is apparently weak the trouble is almost sure to be a broken down winding inside the magneto in which case one should be thoroughly familiar with every detail of the instrument and equipped with the proper facilities before attempting to install a new winding.

W. A. Peters, engineer of Badger Company of Pennsylvania, is in California making a survey of cracking and refining processes in use on the West Coast.

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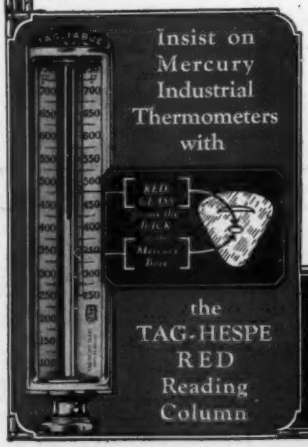

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Steam Protection Against Fire For Oil Tanks

Elaborate laboratory tests determine amount of pressure required for effectiveness

By G. O. Wilson

Secretary, Consulting Board of Engineers, Standard Oil Company of California

Just how much steam is necessary to afford proper protection for an oil storage tank? Experiences in the past, according to Mr. Wilson, in his address made before the American Peroleum Institute at Los Angeles, showed that "just steaming" was not sufficient.

His five conclusions have a valuable place in the story of fire prevention.—Editor.

IT HAS been known for many years that if enough steam is supplied to a confined space containing oil vapors, it will extinguish a fire, or prevent the vapor mixture from burning in that space. Consequently steam smothering has been widely used as fire protection for oil tanks since the early days of the industry. It has been commonly felt that with a "full head of steam" turned into the vapor space of a tank, that tank was protected against ignition by exposure to fires and to a considerable extent at least against electrical storms.

However, a number of cases have been reported during the past few years in which tanks or agitators that had apparently been quite well steamed, were ignited. These occurrences raised a question as to how much steam is really needed to protect a tank. A search of the rather meagre literature on this subject yielded little information. Some theoretical computations were made, and it was attempted to check these with some small scale laboratory tests; but these miniature tests seemed to show much less steam required than the computations indicated. Our company accordingly decided that the subject was of sufficient importance to justify a through investigation. The problem was divided into two parts:

(1). Measurement of the amount of steam required to make a gaseous mixture incombustible, by means of actual ignition tests in a model tank of several cubic feet capacity.

(2). Determination of the time required to reach this steam concentration in full size tanks.

For the first test the apparatus shown in Figure 1 was used. This consisted of a 110-gallon drum with the top head removed and replaced with a loose water sealed bell cover.

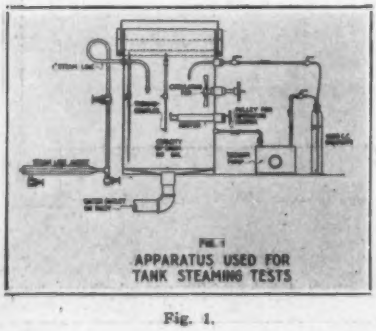

Fig. 1.

Test Apparatus

At first a little gasoline was placed in the bottom of this tank, and vaporization from its surface was depended on to supply the desired vapor mixture in the tank. It was soon found, however, that with this plan the vapor concentration could not be controlled with the desired accuracy. The circulating system shown was accordingly installed. With this equipment the fresh air in the tank at the start could be drawn out, bubbled through a graduate containing light gasoline and returned to the tank. From previous experiments it had been learned that about 25 cubic feet of vapor is produced per gallon of liquid evaporated under the conditions prevailing in these tests. Knowing this factor it was easy to compute the number of cubic centimeters that had to be bubbled off to charge the tank with a given percentage of gasoline vapor. As indicated, a fan was installed inside the test tank to insure a uniform mixture throughout.

The development of a reliable igniter was not a simple problem. An ordinary spark plug was first tried, but this was discarded after a few preliminary tests on account of the difficulties due to short-circuiting when steam was introduced. The white spot apparatus shown was finally developed. This connected to a standard 110-volt circuit through resistance which permitted 30 amperes to flow when the contacts were closed. This gave a very "fat" hot spark when the steel spring wiper left the spark point.

Steam was introduced through a nozzle pointed toward the bottom of the tank—since steam is lighter than air-gasoline vapor mixture. To measure the quantity of steam introduced, thermocouples (electrical instruments for measuring temperature) were placed in the tank, as shown. Knowing the temperature within the drum, it was possible to compute from the steam tables the percentage of steam present at any given time.

Figure 2 is a general view of the apparatus.

As a preliminary check on the performance of this equipment, tests were run without any steam in the drum—just gasoline vapor-air mixtures of varying concentrations. Results checked figures given by the Bureau of Mines and other authorities in that no ignition occurred when the vapor concentration was less than about 1¼% or more than about 6½% by volume. With mixtures just within these limits very slow combustion occurred—just enough to splash a little water out of the seal of the roof, but not enough to lift the cover appreciably. However, as the theoretically correct mixture of gasoline vapor and air for complete combustion was approached—about 3% of gasoline vapor by volume—the firing became very sharp and decisive.

Having demonstrated by these preliminary tests that the equipment provided could be depended upon to cause ignition whenever a combustible mixture was present, the steaming tests were started. The procedure followed was to fill the tank with a mixture of gasoline vapor and air, supply steam

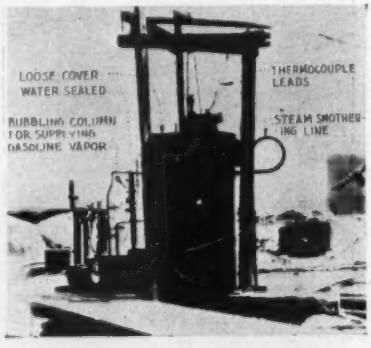

Fig. 2.—General view of test equipment

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until the thermocouples indicated that the desired concentration was reached, and then attempt to fire the mixture by operating the wipe spark igniter. If the ignition occurred, more steam was used in the next test. If the mixture did not burn after sparking had continued for some time, the test was repeated a number of times, slightly varying the proportion of gasoline vapor and air, in order to make sure that the tank was charged at the start with the most combustible mixture.

Amount of Steam Required

The preliminary laboratory tests had indicated that a concentration of about 20% steam, by volume, which is attained when the temperature has reached 140° E., would prevent combustion. These tank tests were accordingly started by steaming to about that temperature; but with this much steam in the tank, it was found that ignition occurred almost every time the spark was struck. However, the combustion was more muffled than with an unsteamed mixture. The temperature was gradually increased in successive tests; and when 160° F. had been reached, corresponding to a steam saturation of about 30%, ignition had become very uncertain. It seldom occurred the first time the spark was struck; and in a number of tests no ignition could be obtained even by operating the wipe spark as many as 100 times. Some 30 tests were run at temperatures between 160° and 170°. One very weak ignition occurred at 163°, and one other so slight as to be barely perceptible at 166°. Absolutely no ignition could be obtained at temperatures higher than 166°.

In the light of these tests, it appears that to make a combustible mixture safe, it should be steamed to a temperature of at least 166°, or say in round figures 170°, which corresponds to a saturation of about 40% of steam by volume. This applies to a gasoline-air mixture of just the right proportions for complete and rapid combustion—about 2½% to 3½% of gasoline vapor by volume. Where the mixture is richer or leaner than this, less steam will be required; 20%, a temperature of

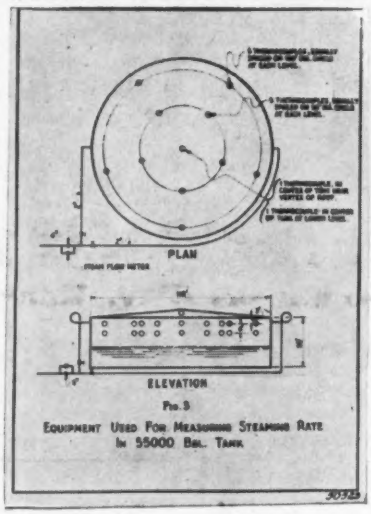

Fig. 3.

EQUIPMENT USED FOR MEASURING STEAMING RATE IN 55000 BBL. TANK

Fig. 3.

140°, may be enough to give protection to a large percentage of tanks, but to be safe under any conditions, the higher saturation of around 40% is necessary.

Having learned with this model apparatus the proportion of steam necessary to make the vapor space in a tank incombustible, the next step was to investigate the time needed to reach this saturation in tanks of different sizes—with steel and wooden roofs, and with steam being supplied at varying rates likely to be available.

Test in Actual Practice

Figure 3 illustrates typical equipment used for one of these tests. It will be noted that in this 55,000-barrel tank (115 feet diameter x 30 feet high) about half full of oil, 22 thermocouples were suspended at various points in the vapor space, and steam was turned in through two typical smothering connections opposite each other near the eaves of the tank. The rate at which steam was being supplied was measured by an orifice meter, and readings were taken on all thermocouples at intervals of two or three minutes.

It should, perhaps, be emphasized at this point again that the "fog" which is commonly spoken of as steam, will not prevent ignition of a combustible mixture. Previous observations that had been made in empty tanks to which steam was being injected had shown that 5 or 10 minutes after the steam was turned on, the tank would be practically full of swirling clouds of "fog" but it was also observed that when this "fog" came in contact with the face it felt cold. The tests in the small drum previously described clearly demonstrated that a gaseous mixture was not incombustible until enough actual uncondensed steam was present to raise the temperature in the vapor space to around 170°. Hence, in these full scale tests, on large tanks, we again relied for on indication of the degree of safety that had been attained in thermocouples which measured the temperature in various parts of the vapor space and thus showed the amount of actual uncondensed steam present.

Figure 4 shows the results of a typical test run in this way. The tank used for this test had a wooden roof and was ¾-full of oil. Steam was supplied at a rate of about 150 boiler h. p. The temperatures plotted on this curve were those indicated by the thermocouple at about the middle of the vapor space, for it was found in this and other tests that with steam coming into the tank at high velocities the turbulence produced resulted in practically uniform heating of the vapor space, provided the oil level was not more than 12 feet of 15 feet below the top. The thermocouples right up under the roof and down near the oil surface, in the center of the tank and near the shell, all read within a few degrees of the same temperature. Hence, the temperatures plotted in Figure 4, which are indications of a thermocouple near the center of the vapor space, represent very closely average conditions throughout that space.

It will be noted that the temperature rose quite rapidly at the start, but as the space inside warmed up, the radiation losses thorugh the shell, of

(Continued on page 38)

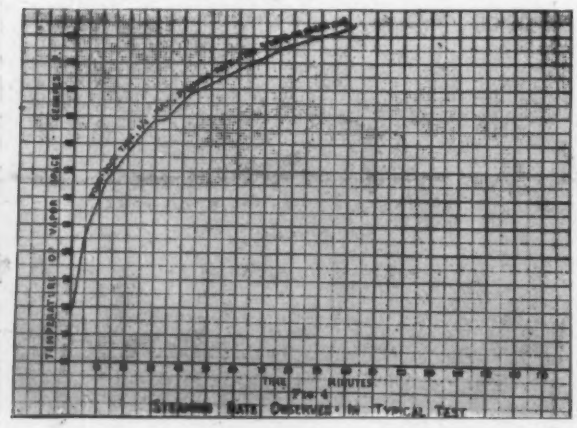

Fig. 4.

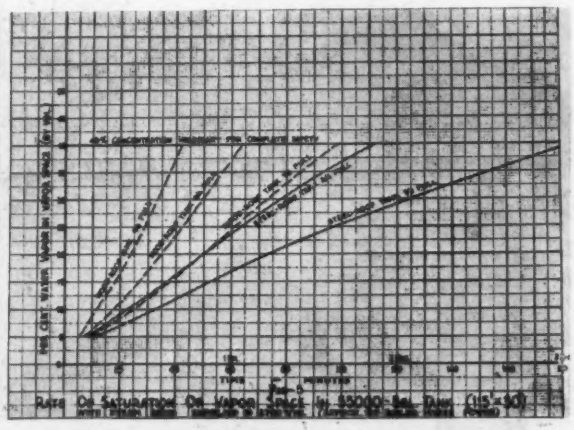

Fig. 5.

JENKINS CRACKING PROCESS

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Installed for

Kanotex Refinery Company

Arkansas City, Kansas

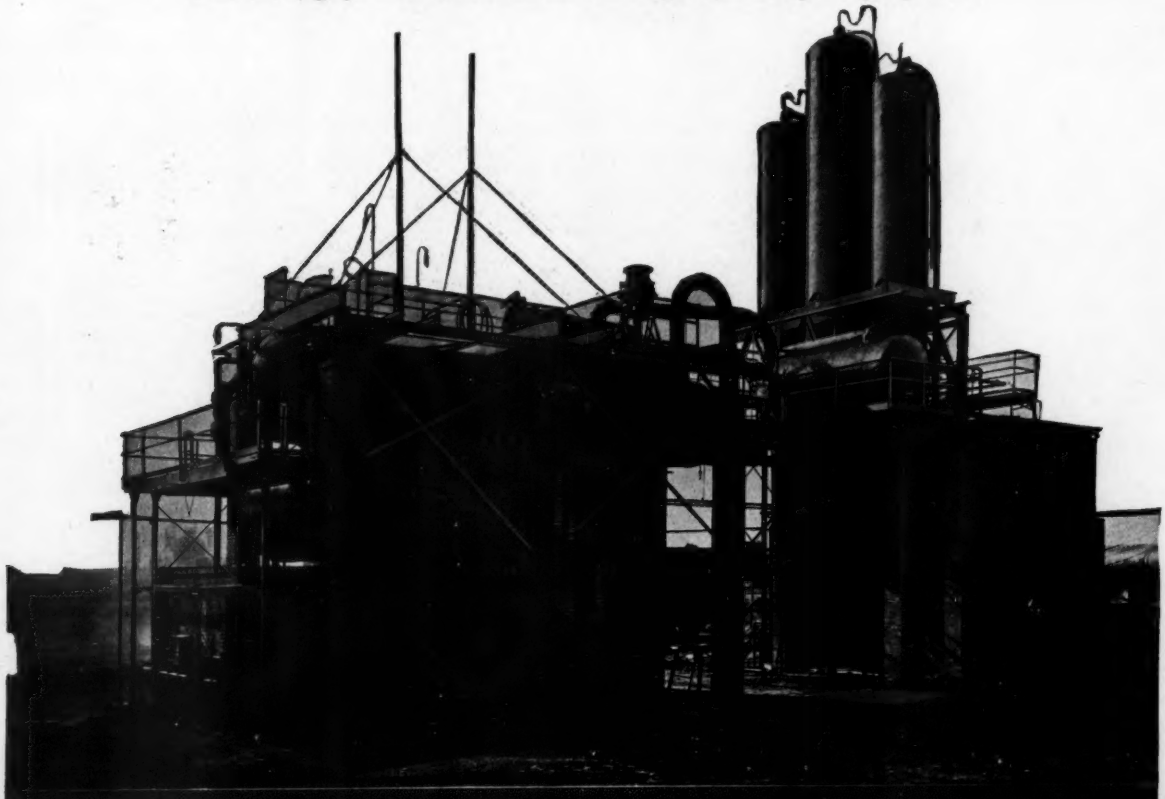
This unit, built for 140 pounds working pressure, is illustrated below.

The brick work at the left encloses the heating tubes only. The upper header drum is located at the left above the dutch oven, the lower header drum at the right and the soaking and vaporizing drum [or still] above.

The weather proof motor for driving the circulating propeller and the goose neck vapor line from the soaking and vaporizing drum to the reflux tower are seen in the upper center.

The reflux tower is between the two bubble towers and the reboiler is located at their base. The condenser box is above the receiving house where all control equipment is located.

The throughput of this unit exceeds the rated capacity by 30%



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until the thermocouples indicated that the desired concentration was reached, and then attempt to fire the mixture by operating the wipe spark igniter. If the ignition occurred, more steam was used in the next test. If the mixture did not burn after sparking had continued for some time, the test was repeated a number of times, slightly varying the proportion of gasoline vapor and air, in order to make sure that the tank was charged at the start with the most combustible mixture.

Amount of Steam Required

The preliminary laboratory tests had indicated that a concentration of about 20% steam, by volume, which is attained when the temperature has reached 140° E., would prevent combustion. These tank tests were accordingly started by steaming to about that temperature; but with this much steam in the tank, it was found that ignition occurred almost every time the spark was struck. However, the combustion was more muffled than with an unsteamed mixture. The temperature was gradually increased in successive tests; and when 160° F. had been reached, corresponding to a steam saturation of about 30%, ignition had become very uncertain. It seldom occurred the first time the spark was struck; and in a number of tests no ignition could be obtained even by operating the wipe spark as many as 100 times. Some 30 tests were run at temperatures between 160° and 170°. One very weak ignition occurred at 163°, and one other so slight as to be barely perceptible at 166°. Absolutely no ignition could be obtained at temperatures higher than 166°.

In the light of these tests, it appears that to make a combustible mixture safe, it should be steamed to a temperature of at least 166°, or say in round figures 170°, which corresponds to a saturation of about 40% of steam by volume. This applies to a gasoline-air mixture of just the right proportions for complete and rapid combustion—about 2½% to 3½% of gasoline vapor by volume. Where the mixture is richer or leaner than this, less steam will be required; 20%, a temperature of

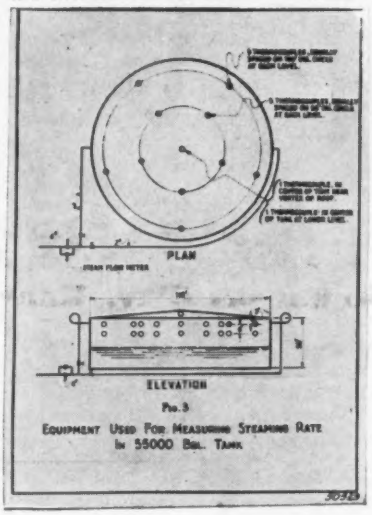

Fig. 3.

Equipment Used For Measuring Steaming Rate In 55000 Bbl. Tank

140°, may be enough to give protection to a large percentage of tanks, but to be safe under any conditions, the higher saturation of around 40% is necessary.

Having learned with this model apparatus the proportion of steam necessary to make the vapor space in a tank incombustible, the next step was to investigate the time needed to reach this saturation in tanks of different sizes—with steel and wooden roofs, and with steam being supplied at varying rates likely to be available.

Test in Actual Practice

Figure 3 illustrates typical equipment used for one of these tests. It will be noted that in this 55,000-barrel tank (115 feet diameter x 30 feet high) about half full of oil, 22 thermocouples were suspended at various points in the vapor space, and steam was turned in through two typical smothering connections opposite each other near the eaves of the tank. The rate at which steam was being supplied was measured by an orifice meter, and readings were taken on all thermocouples at intervals of two or three minutes.

It should, perhaps, be emphasized at this point again that the "fog" which is commonly spoken of as steam, will not prevent ignition of a combustible mixture. Previous observations that had been made in empty tanks to which steam was being injected had shown that 5 or 10 minutes after the steam was turned on, the tank would be practically full of swirling clouds of "fog" but it was also observed that when this "fog" came in contact with the face it felt cold. The tests in the small drum previously described clearly demonstrated that a gaseous mixture was not incombustible until enough actual uncondensed steam was present to raise the temperature in the vapor space to around 170°. Hence, in these full scale tests, on large tanks, we again relied for on indication of the degree of safety that had been attained in thermocouples which measured the temperature in various parts of the vapor space and thus showed the amount of actual uncondensed steam present.

Figure 4 shows the results of a typical test run in this way. The tank used for this test had a wooden roof and was ¼-full of oil. Steam was supplied at a rate of about 150 boiler h. p. The temperatures plotted on this curve were those indicated by the thermocouple at about the middle of the vapor space, for it was found in this and other tests that with steam coming into the tank at high velocities the turbulence produced resulted in practically uniform heating of the vapor space, provided the oil level was not more than 12 feet of 15 feet below the top. The thermocouples right up under the roof and down near the oil surface, in the center of the tank and near the shell, all read within a few degrees of the same temperature. Hence, the temperatures plotted in Figure 4, which are indications of a thermocouple near the center of the vapor space, represent very closely average conditions throughout that space.

It will be noted that the temperature rose quite rapidly at the start, but as the space inside warmed up, the radiation losses thorugh the shell, of

(Continued on page 38)

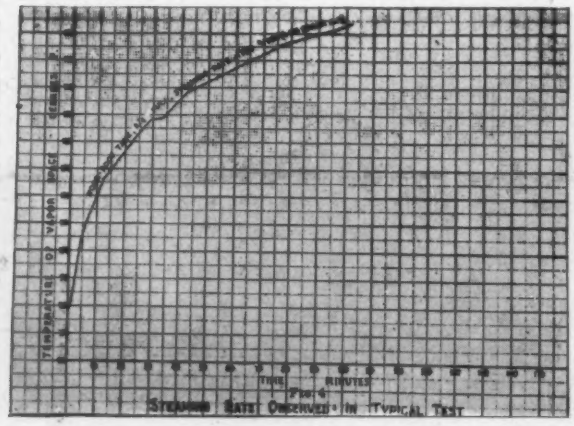

Fig. 4.

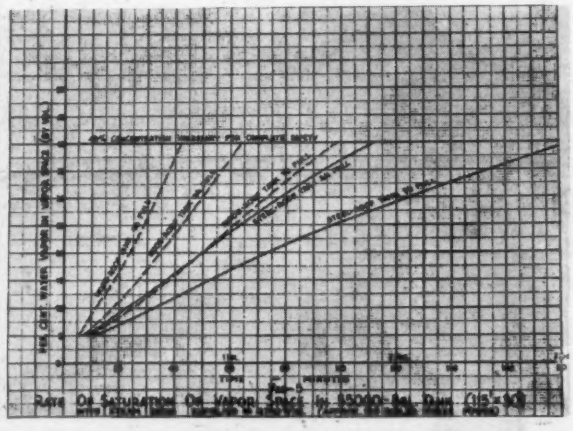

Fig. 5.

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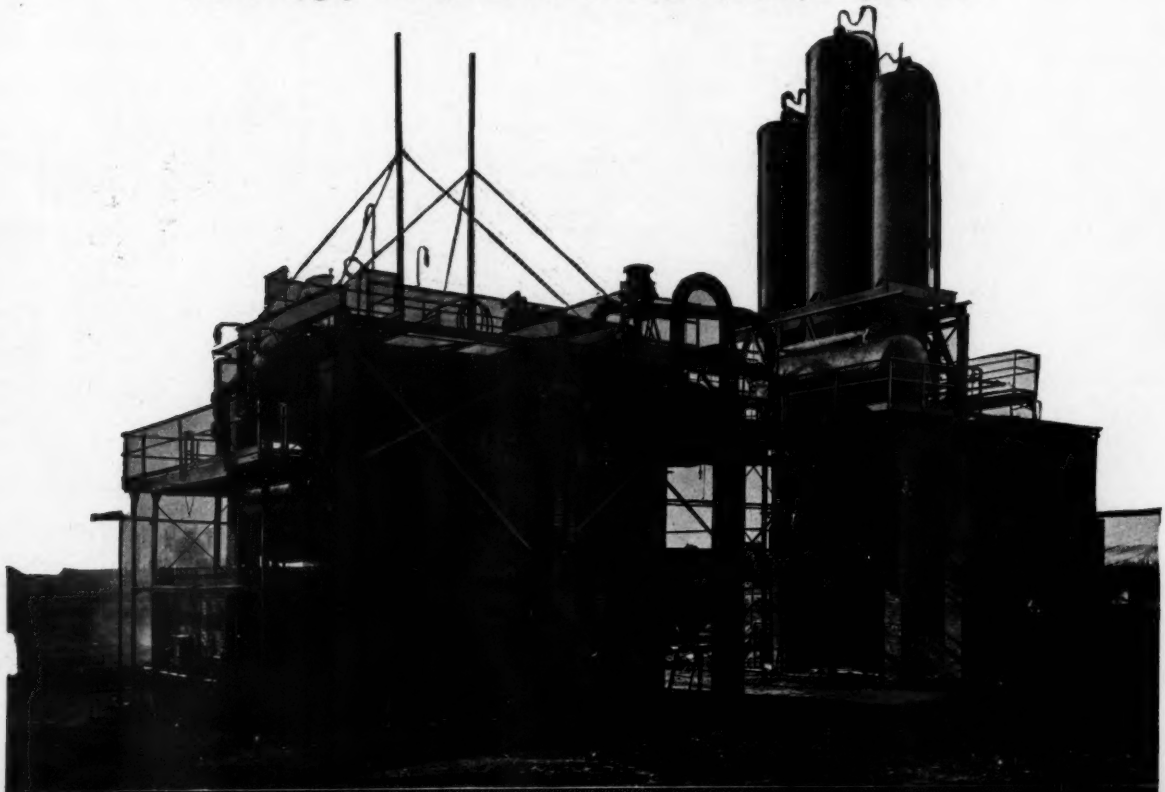
The weather proof motor for driving the circulating propeller and the goose neck vapor line from the soaking and vaporizing drum to the reflux tower are seen in the upper center.

The reflux tower is between the two bubble towers and the reboiler is located at their base. The condenser box is above the receiving house where all control equipment is located.

The throughput of this unit exceeds the rated capacity by 30%



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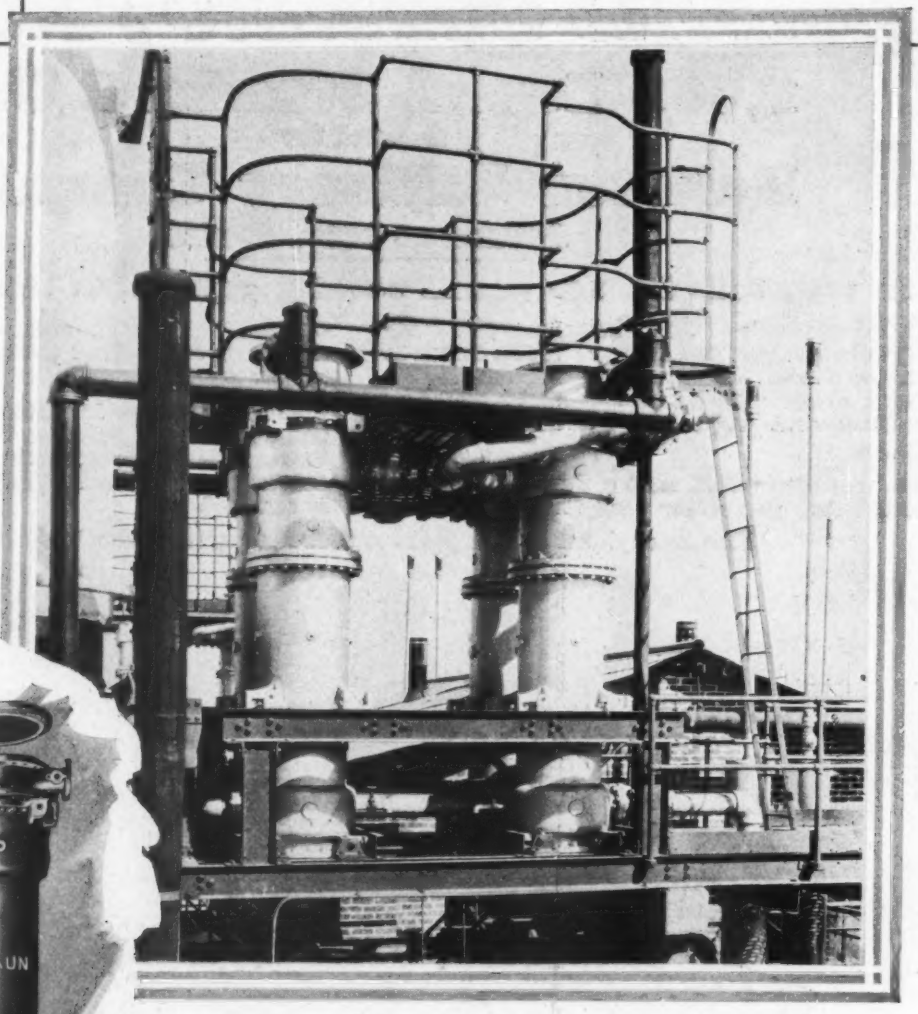

Braun type "ETS" vertical condenser with heads removed for cleaning. For ease of cleaning this condenser is ideal. The upper channel cover may be removed without breaking any pipe connections and the scale washed down through the tubes in a short time.

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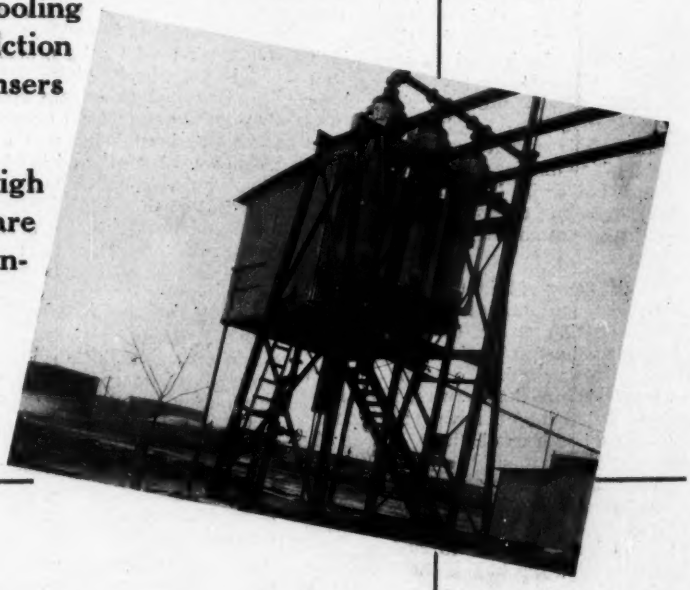
Many similar instances of the high efficiency of Braun apparatus are commanding the attention of refiners throughout the Industry.



Right: Three vertical condensers handling 2500 bbls. per 24 hours. Temperature of gasoline is reduced to within 5 degrees of cooling water.

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course, became greater, so that the rate of heating gradually slowed down. The safe temperature of 170° was not reached until steam had been going into the tank, at the high rate of 150 boiler h. p. used in this test, for one hour and five minutes.

A considerable number of tests were run in this way, with various steaming rates and oil heights, and in tanks with both steel and wooden roofs. From the result obtained we were able to construct an equation by means of which the rate of increase in steam concentration can be computed for any given conditions—size of vapor space, kind of tank, roof and rate of steaming. Figure 5 shows a number of curves plotted from this equation, for a 55,000-barrel tank. For all of these curves the steaming rate assumed was the same as in the typical test previously described—150 boiler h. p. Instead of plotting temperatures, as was done in Figure 4, the percentage of steam in the vapor space, which is really the important consideration, has been plotted in Figure 5. The curves show that with 150 boiler h. p. available for steaming a 115x30-foot tank, the time required to reach 40% saturation of the vapor space will vary from ½-hour to three hours, depending upon the fullness of the tank and the type of roof.

Time Required

Even a half hour is a long time to get a tank into a safe condition, when 150 boiler h. p. is being used for this purpose and of course by the end of three hours the hazard against which we are attempting to protect by steam smothering will probably have long since passed. In the light of these test results, it is easy to understand how tanks which had been steamed for some time could easily have been ignited if subjected to exposure fires, static sparks, or atmospheric electrical discharges.

In the course of the tests on non-gas-tight wooden roof tanks, it had been observed that steam, or rather "fog," began to show at the hatches and roof cracks a few minutes after the test started—before the thermocouple inside showed that any effective concentration of steam had been obtained. To an observer standing on the ground, there appeared to be practically as much steam leaking out during these early stages of the test as when the concentration had increased to 20% or 30%. This created the impression that there might be a local concentration of steam, just under the roof; but since, as previously mentioned, the thermocouples placed close to the roof showed that this was not the case, it was concluded that the appearance of the tank being steamed evidently gave a very unreliable indication as to the degree of safety that had been attained.

To check up more definitely on this point some further tests were run with the model tank, with minor changes

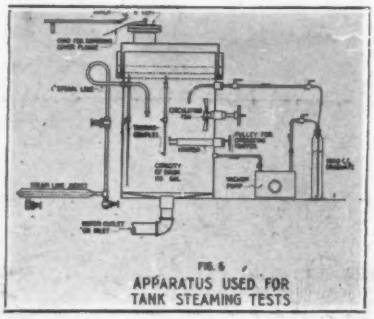

Fig. 6

in the cover as shown in Figure 6—these changes consisting mainly of inserting a six-inch outlet, and resting on top of it a loose blind flange, with a cord attached so that it could be jerked off when desired. A torch was mounted so that an operator at a distance could bring it up close to this vent after it had been uncovered.

A number of tests were run with this apparatus which demonstrated that even though a tank has been steamed to such an extent that copious clouds of "fog" will issue from the vent when this is uncovered, a flash back is liable to occur if a flame is brought near the open vent before the safe concentration of 40% of steam has been reached inside the tank. These tests incidentally demonstrated that a mixture which has not been steamed to a safe condition is just as liable to be ignited by any exposure fire as by the hot electric spark used in the previous series, and in some tests where the tank has been steamed to a safe condition so that ignition would not occur when the torch was brought up to the vent, the steam was shut off, and inside of about 30 seconds, enough condensation had occurred so that the mixture again became combustible and a flash-back occurred. In a few tests the steam nozzle was pointed up so as to discharge directly through the vent, and it was found that if the steam were well distributed throughout the opening, it might prevent a flash-back into a tank containing a combustible mixture. Further tests along this line on actual tank breather valves and vents will be discussed later.

The tests described thus far furnish definite answers to the questions that were asked at the start; they showed that—

(1). A steam concentration of approximately 40% corresponding to a temperature of 170° must be reached to make a combustible mixture of gasoline vapor and air non-inflammable.

(2). A relatively long time is required to reach this concentration in the vapor space of tanks under average conditions.

Incidentally they brought out the facts that—

(3). The appearance of considerable quantities of "fog" issuing from roof cracks or hatches is no sign a tank is in a safe condition.

But these very answers served to raise new questions:

Why Use Steam?

(1). If steam is so relatively slow and unreliable in providing the desired protection, why has it been regarded for so many years as a safeguard which should not be omitted from any tank within the range of a boiler plant. And—

(2). If it is of such doubtful value, should we continue to use it for tank protection?

An attempt to answer these questions requires first of all that we take into account the change in the type of tank roof construction that has occurred quite generally throughout the industry in the past few years. Until recently a great majority of our large storage tanks were equipped with wooden roofs, covered either with galvanized iron or tarred paper. In but few cases were such roofs even approximately gas-tight. The wind generally blew into the cracks on one side of the roof; and a mixture of air and oil vapor seeped out through those on the other side. This created a fire hazard in two ways. First, the combustible vapors leaking out through a multitude of openings in the roof were lible to be ignited by any stray brand or electrical discharge; and second, the fresh air leaking into the tank diluted the vapor mixture inside the tank to combustible proportions.

Under these conditions, in case of a threatened lightning storm or exposure fire, about the only hope of protection was to inject steam as fast as possible. If the tank were quite full, or if it were near enough to the boiler plant so that a high rate of steam delivery was available, or if the roof were fairly tight, so that not enough air had leaked in to dilute the mixture to the point of maximum combustibility, there was a fair chance that, in a relatively short time, a safe condition would be reached.

Furthermore, as a protection against atmospheric electrical discharges, steaming such loose-roofed tanks probably had another good effect. This is the fact that condensed steam may collect on the under side of the roof, and furnish temporary electrical connection between the metal sheets with which it is covered. Under these circumstances, static discharges occasioned by a bolt of lightning in the near vicinity may be conducted by the water, instead of producing sparks in jumping from place to place.

On all of these counts, it is easy to see how steam established its reputation as a safeguard for oil tanks of the old type, with roofs that were far from gas-tight. But in the light of our test results we must realize that there may be conditions where safety is not attained by this process until steam has

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been going into the tank for a long time.

Tight Tanks

When we consider a tank with a modern gas-tight steel roof, we find the picture entirely different. In the first place, since there are no cracks for the wind to blow through, the mixture inside is much more likely to be saturated with oil vapors to such an extent that it will not burn. A graphic demonstration of what this may mean was afforded in a fire at Monterey a year or so ago. Six tanks containing crude burned; and, as is characteristic of crude oil fires, each boiled over during the course of the fire. On the downhill side of these tanks stood a 7,500-barrel tank containing gasoline. When the flaming oil from the first boil-over flowed down around this tank, the sudden heating up of the vapor space pushed off the loose water-seal cover of the roof manhole, and the vapors issuing from this 11-inch opening burned as a torch which at times reached a height of several feet.

When the boil-over around this tank had burned up, and the tank started to cool off, this torch died down and quietly snuffed itself out. The vapor inside the tank was too rich to burn; and as there was no outside heat to push this vapor out of the manhole, there was nothing to feed the fire. This experience was repeated a number of times during the 24 hours that the crude tanks burned; immediately after each boil-over a bright torch could be seen burning at the manhole of the gasoline tank, and each time the boil-over oil burned out, the torch died down and snuffed itself out. It was reported that after the fire a gauge of the tank showed that less than one inch of gasoline had been evaporated.

When a tank contains a vapor mixture as rich as did this gasoline tank there is obviously nothing to be gained by forcing steam into it. As a matter of fact, such injection of steam might do actual harm, in either of two ways. First, it would force some of these rich vapors out through the vent, perhaps to be ignited by any exposure fire that might be near. The experience at Monterey demonstrated that such a vent fire may be harmless, but it is certainly undesirable, and under certain conditions might so warp the roof that holes would open up through which air could leak in and dilute the mixture to a combustible condition. And such a vent fire is less likely to occur if the tank is allowed to stand untouched, than if a large amount of vapor is forced out by the inaction of steam.

The second and more serious difficulty that may be encountered if steam is injected into a tank containing a rich mixture, develops in case the steam is for any reason shut off while there is still an exposure fire in the vicinity. As observed in the tests with the small drum, previously mentioned, when steaming stops, condensation occurs

Fig. 7. Vent smothering test with steam just turned on

very rapidly, and considerable quantities of air are thus drawn into the tank. This air will dilute the mixture immediately under the vent to a combustible condition. Furthermore, the in-draft will tend to suck flames from any nearby exposure down the vent.

Too Rich Vapors

Realizing these facts, it is evident that by injecting steam into a gas-tight tank where the mixture was originally too rich to burn, one places himself in the unenviable position of the fellow who caught a bear by the tail. He has to hang on—and this may not always be possible, in case of broken steam lines, need for steam to transfer oil, or other contingencies.

There are, of course, some conditions in which the vapor mixture inside a gas-tight tank will not be too rich to burn, even though there are no leaks in the roof for the wind to blow through. For example, the oil in the tank may have a low enough vapor pressure so that it will not saturate the space above it sufficiently to produce this too-rich mixture. And even in those tanks that do normally contain a too-rich mixture, air will be drawn in when the tank cools off at night, or when oil is pumped out of the tank. We have made a great many observations, particularly on gasoline tanks, which have indicated that the dilution which takes place in this way is ordinarily confined to a comparatively small volume under the vent.

In fact, unless the air is drawn in quite fast, by a rapid delivery of oil from the tank, diffusion will result in keeping practically the entire vapor space of a gasoline tank in a condition too rich to burn.

There are thus relatively few conditions where we have a combustible mixture inside a gas-tight tank. Where such conditions do exist, it may at first glance seem that here is a case comparable to that of the loose-roofed tank, and that the best thing to do is turn in steam as fast as possible in case the tank is exposed to fire, and hope that there will be time enough to get in a sufficient amount to make the tank safe before the flame actually comes near the vent. Further consideration, however, shows that this is not the best plan for a number of reasons.

In the first place, the very fact that the tank has a steel roof, which radiates heat much more rapidly than the old wooden roofs, will, as previously explained, result in a much longer time being required to get a safe concentration of steam inside the tank. In the second place, injection of steam will immediately start forcing a combustible mixture out through the vent, and this presents a more serious hazard than in the case previously discussed, where a mixture inside the tank was too rich to burn. For if these issuing vapors should become ignited they might flash back into the tank—although supplementary tests which were conducted showed that even with a mixture of combustible proportions coming out through a vent there are a number of conditions that will tend to prevent a flash-back from occurring.

Protection of Gas-Tight Tanks

However, it is evident that there are disadvantages to injecting steam into a gas-tight tank in which the mixture is combustible, just as there were in the case where the mixture is too rich to burn.

This does not mean, however, that steam has no place in the protection of gas-tight tanks. As a matter of fact, we found by a number of tests of steam smothering jets applied at the vents of such tanks, that this form of steam protection is likely to be more effective than the best protection we were ever able to give the old loose-roof tanks under most conditions. These tests showed that with a very moderate rate of steam flow—¼ to ½ the rates used

Fig. 8.—Fire out

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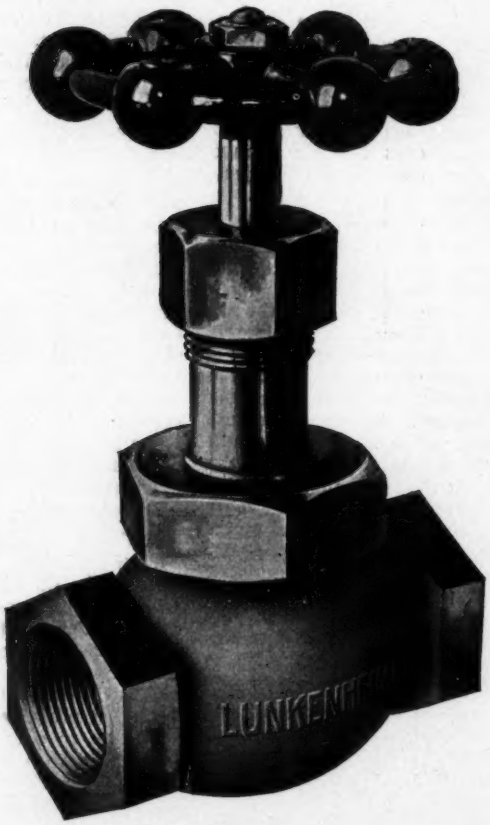

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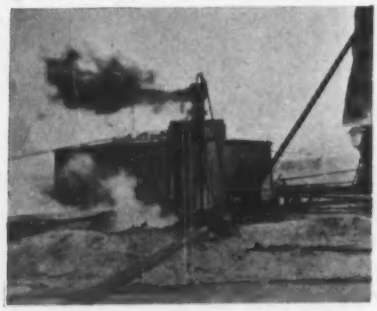

Fig. 9.—Air-gasoline vapor fire at breather valve

in the previously described tests where steam was injected into the tanks—we could extinguish a hot vent fire, or prevent a flash-back in the case of combustible mixtures issuing from the vent. And the best part of it is that this protection is available a few seconds after the steam reaches the vent—instead of having to wait from a half hour to three hours, which we found to be the case when steam was injected into the tank.

Figure 7 shows a vent steaming test on one of our old type of tank breather valves having two pairs of pressure and vacuum ports closed by discs which seat in a mercury seal, placed at the top of a large riser through which mixtures of natural gas and air were discharged. A steam nozzle was set up so that the jet would pass under the hood of the valve in Figure 7 the steam has just been turned on, and the fire is still burning, the blow pipe action of the steam making the flame practically invisible. Figure 8 was taken a moment later—just after the steam had extinguished the fire. With this equipment it was found that with rich mixtures of gas and air being discharged at rates up to 25,000 cubic feet per hour, the fire could be blown out in a few seconds with steam supplied at rates as low as 40 boiler h. p.

The tests illustrated in Figures 7 and 8 were made with natural gas-air mixtures. Figure 9 shows a test in progress on one of our present single-port type breather valves discharging 27,000 cubic feet per hour of rich gasoline-vapor-air mixture. This rate of discharge would occur only if a tank containing very little volatile gasoline were being pumped into, at a rate around 5,000 barrels per hour, which is of course a condition more severe than anything likely to be encountered in practice. Figure 10 shows the cloud of steam which extinguished such a fire a few seconds after it was turned on at a rate of about 70 boiler h. p., and Figure 11 illustrates the slotted ring surrounding the outlet of the valve through which the steam was supplied.

Fig. 10.—Just after the fire had been extinguished

In these tests we were extinguishing fires which were burning at vents through which rich mixtures were being expelled. Figure 12 shows the set-up for a test which a combustible mixture was to be expelled through the open vent, and steam delivered from the jet to prevent a flash-back. The flaming torch shown in Figure 13 was held in various positions around the vent, but no flash-back occurred as long as the steam rate remained higher than about 30 boiler h. p. In some tests a flash-back occurred when the rate was reduced to 20 boiler h. p.

A considerable number of tests of the sort illustrated in the last few pictures were run on various types of vent. They all lead to the same conclusion—that a steam jet delivering from 30 to 50 boiler h. p. will extinguish a vent fire of rich vapors, or will prevent a flash-back of a combustible mixture, provided the steam is thoroughly distributed around the vent opening. Higher steaming rates may be necessary under especially severe conditions, but a jet delivering 75 boiler h. p. was able to protect vents discharging as much vapor as would ever be likely to be encountered in practice.

A detail in connection with the installation of these jets which might appear to be of minor importance, but which really demands careful consideration, is the fact that they should not be so placed as to discharge the blast of steam directly into the vent, for if this is the case a surprising amount of back-pressure may build up in the tank—enough to open any emergency relief hatch with which the tank may be provided, which is just what should be carefully avoided.

The tests described have demonstrated that smothering jets can be successfully applied to a number of different types of tank vents and breather valves. However, this form of steam protection is a rather new development and further experience will doubtless disclose many improved methods of applying such jets to the various forms of tank breather valves and vents that are in service throughout the industry.

Summary

The various tests that have been described have brought out the following facts:

(1). A considerable amount of steam must be introduced to a gaseous mixture to make it incombustible. When gasoline vapor and air are mixed in just the right proportions for complete combustion—about 3% of gasoline vapor by volume—40% of steam must be introduced to obtain safe conditions; this corresponds to a temperature of about 170° F., throughout the vapor space.

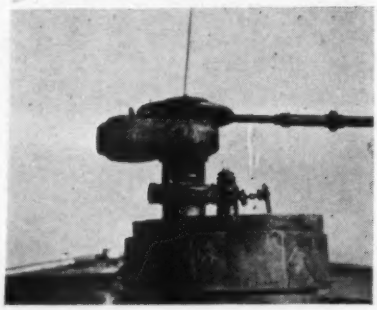

Fig. 11.—Steam smothering ring for breather valves

(2). With steam being supplied at 150 boiler h. p. to the vapor space of a 55,000 barrel tank, a period ranging from one-half hour to three hours will be required to reach this safe steam concentration.

(3). The appearance of steam or "fog" issuing from the roof cracks or hatches of a tank is no indication that the space inside has been steamed to a safe point.

(4). If a tank containing volatile stock is equipped with a modern gas-tight steel roof, the vapor space inside will be either (a). Filled with a mixture too rich to burn, in which case there is nothing to be gained by injecting steam, and doing so may actually introduce a hazard or, (b). Under comparatively rare conditions, it may be filled with a combustible mixture, in which case a long period of steaming at a high rate is generally necessary to attain a safe condition, during which combustible gases will be expelled from the vent.

(5). Regardless of the condition inside the tank, the only place where a gas-tight tank can be fired is at the vent. A steam jet delivering 35 to 50

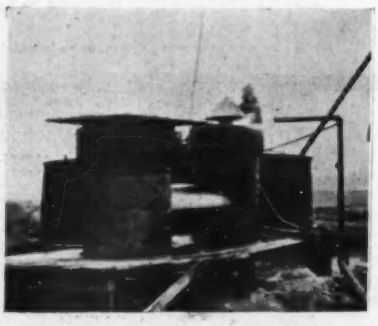

Fig. 12.—Equipment used in the test for preventing flash-back through open valve

More Millions Need Gasoline

Last year was a big year for motor car sales. Whether or not all records are broken again this year, there will certainly be a few million more cars in service. All of these cars must have gasoline and will get it.

Even if the railroads continue to move all freight cars with unprecedented speed, more tank cars than ever before will be needed during the months to come.

Better make sure that your tank car fleet is up to full "war strength"—ready to meet all competitors in any car shortage emergency that may arise.

Always Get a "Car Foundry" Quotation

American Car & Foundry Company

165 Broadway
New York

Railway Exchange Building
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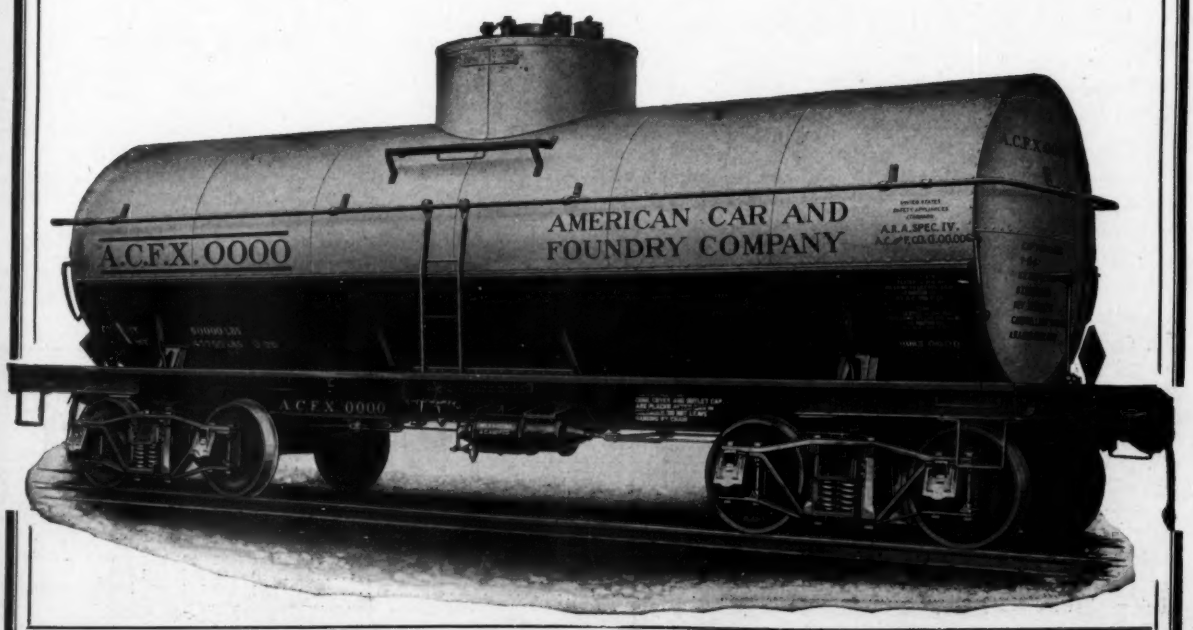


boiler h. p. will, if properly distributed around the vent, extinguish a vent fire, or prevent a flash-back into a combustible mixture under ordinary conditions. Extreme conditions can be controlled with 75 boiler h. p.

(6). Such vent protection is available a few seconds after the steam reaches the nozzle—instead of having to wait for periods that might be as long as several hours, if steam were injected into the tank.

In conclusion, it may be pointed out that the practice of injecting smothering steam into the vapor space of tanks has probably filled a useful place in the fire protection measures available for tanks with non-gas-tight roofs. The modern gas-tight steel roof needs little protection of any kind, but where steam is used it can apparently do the most good in the shape of a jet protecting the vent.

Acknowledgments

The tests described in this paper were carried on under the general direction of Mr. H. H. Hall, chief engineer of the Standard Oil Company (California). They were actually conducted by Messrs. J. A. Ryan of the manufacturing Development Department; H. E. Geyer of the Engineering Department, and D. W. Rohrback of the Pipe Line Department—to all of whom, as well as to Mr. M. B. Anfenger of the Engineering Department, the writer is indebted for suggestions regarding the paper.

Humble Buys Plant

Breckenridge, Texas.—Humble Oil & Refining Company has purchased the Baltic Gasoline Company's natural gasoline plant in Stephens Counnty for a cash consideration of $250,000. This plant is located southeast of Breckenridge on the P. Swenson land, section 5, Orphan Asylum land survey, and was manufacturing about 4600 gallons of gasoline daily. Equipment in the plant permits the handling of 8,000,000 cubic feet of gas daily and Humble controls enough gas besides that acquired with the plant to put it on maximum capacity.

Plant for Gulf

Breckenridge, Texas.—Gulf Production Company is showing renewed interest in expanding its natural gasoline activities, and during December purchased Snowden & McSweeney's absorption plant, located one mile north of Breckenridge, for a cash consideration of $160,000. This plant was built by Snowden & McSweeney on the J. G. Higginbotham lease during the early stages of the natural gasoline industry in Stephens County, and is producing about 3,000 gallons of gasoline daily, with equipment on hand to handle 6,000,000 cubic feet of gas daily.

West Texas Natural Gasoline Shipments Lower for 1925

Fort Worth, Texas.—Shipments of natural gasoline from plants in North and Central West Texas during the year 1925 amounted to 203,649,684 gallons as compared to a total of 212,906,568 gallons in 1924, and 185,845,548 gallons in 1923. These figures indicate that the year 1924 goes on record as being the peak of production for the district, although the number of individual plants and total investment in equipment grows each year. The decline in natural gasoline production is mostly confined to the leading manufacturing centers—Eastland, Stephens and Wichita Counties, while the recent expansion of the industry into virgin fields is partially overcoming the loss sustained by these older fields.

During the year 1925, plants were erected in the high gravity shallow oil belt in lower Wichita, Archer and upper Young Counties, and placed in operation. The Waskom gas field in East Texas, Wortham and Mirando fields each were supplied with natural gasoline plants during the past year, but the gasoline shipments are not included in the above totals. The South Vernon field in Wilbarger County was entered by Humble early last summer with a good-sized plant, while the high gravity oil and gas field straddling the Carson-Hutchinson County line in the Texas Panhandle was given its first plant by the Phillips Petroleum Company at the close of 1925. This latter plant promises to develop into being one of the largest in the world, since Phillips is going after gas contracts that will require a record sized plant to handle same. However, the gasoline yield is somewhat small and the production must be piped about 20 miles to the nearest railroad point. The Big Lake field in West Texas received its first plant in 1925, and the Westbrook field in Mitchell County is to be furnished natural gasoline early this spring from a small plant now being erected by the California Company.

Natural gasoline shipments from plants in North and Central West Texas averaged 16,970,807 gallons monthly during 1925, and 17,671,751 gallons monthly during the preceding year. During the first six months of 1925 a total of 98,143,794 gallons were shipped to various refining centers in the Mid-Continent, Gulf and Atlantic Coasts, while the shipments during the last half of 1925 amounted to 105,505,890 gallons, thereby indicating that production may again be on the increase, even though the major natural gasoline centers are falling off rapidly. It is estimated that about 25,000 insulated tank cars were required to transport the 1925 output of natural gasoline from North and Central Texas fields last year.

Shipments of natural gasoline from various manufacturing centers in North and Central West Texas during October, November and December, and the totals for 1925 are shown in the accompanying table.

Fields—	Oct.	Nov.	Dec.	Totals 1925.
Eastland County	165,135	158,037	162,735	1,964,776
Stephens County	164,975	164,600	169,088	1,728,483
Burkburnett	46,623	45,325	36,985	463,656
Electra	17,245	19,950	19,005	193,584
Shackelford County	17,210	18,033	17,145	200,953
Young County	9,869	14,465	13,400	142,997
South Vernon	7,205	9,160	7,750	42,808
Clay County	4,800	4,800	4,790	56,430
Archer County	3,760	3,467	2,990	20,428
Potter County	1,403	1,363	1,345	13,001
Iowa Park	1,590	1,450	1,475	4,505
Reagan County	1,600	975	1,770	10,095
Brown County	512	384	720	7,586
Totals in barrels (42 gallons)	441,917	442,009	439,198	4,848,802

Greene Brothers Announce Opening of Dallas Office

Dallas, Texas.—Greene Brothers, distributors of refinery and power plant equipment, have opened an office in Dallas, with R. E. Hudson in charge. Headquarters are in the Magnolia Building. The concern has previously had but one office, in Wichita Falls.

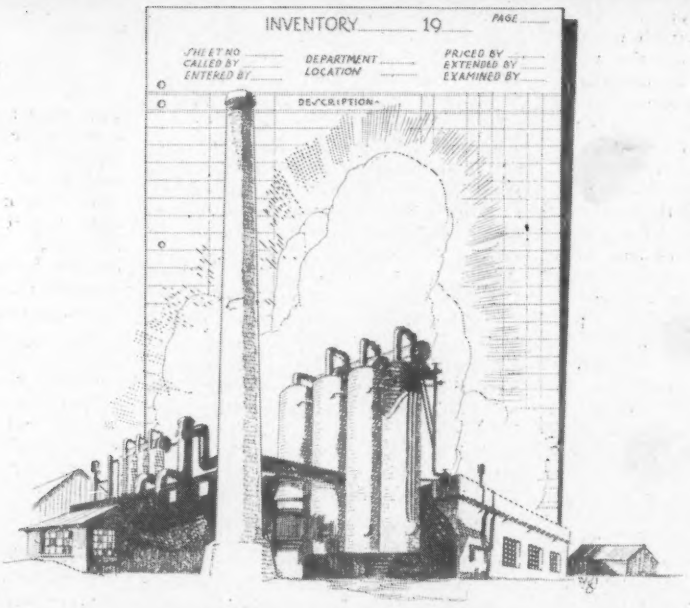
The firm is distributor in North Texas for products of the following manufacturers: C. J. Tagliabue Manufacturing Co.; Merco Nordstrom Valve Co.; Hills-McCanna Co.; Mathieson Alkali Works, Inc.; J. T. Baker Chemical Co.; The Meriam Co.; Joseph W. Hays Corp.; Corning Glass Works; Kimble Glass Co.; Brown Instrument Co., and the Key Boiler Equipment Co.

Not to Abandon

The Continental Oil Company has denied reports that it contemplated abandoning its refinery at Farmington, New Mexico, which operates on crude from the Rattlesnake dome.

The refinery is shut down at present, but the company advises that this is due only to the seasonal decline in refined products. The refinery will remain closed for a short time yet, it is stated, but will in the near future resume operations.

SIL-O-CEL
HEAT INSULATION



Take A Heat Inventory

Wherever fuel is used, it pays to trace down B. t. u. losses.

Once located they are only partially avoidable, of course. But the savings that can be effected simply by insulating exposed hot surfaces amount to a hundred per cent return on the necessary investment in insulation in most cases.

For example, an un-insulated still setting composed of 9 inches of fire brick and 8 inches of red brick wall, when the inside temperature is 2000°F. will waste 630,000 B. t. u. per hour per thousand square feet of exposed area. Insulation will reduce this loss sixty per cent, a saving equivalent to 3.6 gallons of oil, or 31.5 pounds of coal, per hour, for each thousand square feet.

In addition to saving fuel insulation increases the capacity of heated equipment, and improves temperature control. It enables the use of water-proofing and air-sealing preparations over hot brick surfaces. And it insures cooler, more comfortable working conditions about the equipment in which it is used.

May we send you our complete handbook on the insulation of oil refinery equipment. Write our nearest office on your business letterhead.

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IN PRINCIPAL CITIES

Tell them where you saw the ad

Position of Refiner and Natural Gasoline Manufacturer

(*Continued from page 16*)

card from the gasoline fraction because if they were all included in the finished gasoline the various intermediate points of the sales specifications could not be met.

The problems of "what is good natural gasoline" from the gasoline manufacturer's standpoint is simple enough. Good natural gasoline from this viewpoint is simply any kind of natural gasoline that you can sell and get money for over a period of time long enough to retire your investment and make as much profit as possible. It would appear that the question of "what is good natural gasoline from the refiner's viewpoint" would be very much more complex. This need not be true, however, because inasmuch as the natural gasoline manufacturer is anxious to make as much salable gasoline as possible, the refiner is equally anxious to buy as much as possible of natural gasoline, or any other commodity, the purchase of which will show him a profit. If the California natural gasoline industry proposes to base the sale of its product on the temporary trying market conditions under which the refiner is suffering, this industry has a very unstable foundation. If, however, a reasonable attempt is made on the part of the natural gasoline manufacturers of California to furnish the State's refining industry with a product which it will be advantageous for the the latter to buy at a good price for years to come, the natural gasoline business will be established upon a firm and profitable basis. This, then, is purely a matter of price and specification. Assuming equitable specifications, the price which the refiner can pay for his natural gasoline depends, curiously enough, on the efficiency with which his refinery is designed and operated.

Cost

Let us assume that a certain crude contains 25 per cent of gasoline as indicated by any approved form of efficient laboratory distillation. If this crude is run through an inefficient refinery and due to poor dephlegmator design and sloppy operation only 20 per cent of gasoline is extractable from the crude which meets the intermediate and end points of a certain specification, the gasoline made at this refinery will probably have a higher gravity but will also cost very much more per gallon than one made by a more efficient plant. This gasoline has got to be sold in competition with the product from the most efficient refinery operating in the same market. Therefore, the owner of the inefficient refinery cannot afford to use as much natural gasoline or pay as high a price for this commodity as he could afford if his straight run naphtha had not cost him so much due to inefficient crude distillation.

Concurrently, the operator of a highly efficient and scientifically controlled refinery will be able to extract from this certain crude very close to the theoretical amount of gasoline which it contains, let us say the full 25 per cent represented by the laboratory distillation, or even more. By figuring on judicious blending with natural gasoline this refiner will not even stop there. He will cut a refinery naphtha which exceeds the maximum limits set by his sales specifications in several intermediate points and also slightly by the end point. Thus, having extracted from his crude as potential gasoline all the gasoline there is in it, plus a considerable proportion of hydrocarbons which would have gone into the fuel residuum or very low priced distillates, he is able to buy, and in fact until cracked substitutes are available, he absolutely must buy a relatively large amount of natural gasoline in order to blend his refinery naphtha down to meet the various intermediate and end point requirements and furnish the competitively desirable low initial point. Obviously, a refiner operating on the latter basis is able to pay a higher price for natural gasoline simply due to the fact that his straight-run costs him very much less than if he had attempted to make a finished motor gasoline from crude alone.

Future Price

Judging from present probabilities, and again assuming fair specifications, it is likely that as far ahead as we can see natural gasoline in California will be worth more delivered at refinery than motor gasoline will be worth at the same refinery. How much more is a serious question. At the present time natural gasoline in southern California is selling at an average of 15 cents a gallon in the field with the refinery price of motor gasoline approximately 10 cents per gallon.

There is very good reason to believe that with the general adoption of large scale cracking and the previously mentioned likelihood of sales of gasoline with a higher intial in the not too distant future, that this differential in price between natural gasoline and finished motor gasoline at the refinery will decrease. As the price of natural gasoline is customarily compared with the price of retail gasoline, the foregoing statement would have to be reversed to say that the price differential between natural gasoline and retail gasoline will show a tendency to increase as cracking becomes prevalent and the retail gasoline market changes from a buyer's market to a seller's market. All of this is based on the assumption that the present generally unsatisfactory methods of writing natural gasoline specifications is continued.

Specifications

As previously mentioned, no attempt will be made here to propose any standard specifications under which natural gasoline is to be bought and sold in the California market. At the same time it is definitely realized that both the refiners as buyers and the natural gasoline manufacturers as sellers are being seriously injured at the present time by adherence to poor specifications.

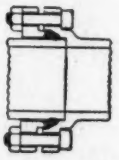
Many specifications under which natural gasoline is now being bought and sold in California to the tune of millions of dollars have been written without adequate knowledge of the nature of the product being dealt in and with a very obvious lack of mutual consideration between the buyers and seller. The attitude of the average buyers of natural gasoline has been to limit the natural gasoline manufacturer in every way possible in order to minimize evaporation losses as far as possible and at the same time to obtain a natural gasoline which is desirable in all other respects. The typical seller's attitude has been to obtain specifications so liberal that the gasoline manufacturer can ship and obtain money for most anything he could get into tank car, truck or pipe line.

At the present time most natural gasoline specifications include limits on color, gravity, end point, vapor pressure, distillation recovery and sometimes more special tests such as initial boiling point and sulphur and gum as represented by the doctor and copper dish.

Color Specification

There is little or no room for argument on color specifications. If the natural gasoline is desired for cold blending, its color should certainly be at least as good as that required in the finished motor gasoline. A Saybolt color of 23 to 25 is customary in California. There is no reason why any gasoline manufacturer with an adequate plant cannot make a color as good as this without difficulty. If the gasoline is run into crude oil lines or is otherwise destined for hot blending, any color should be good enough, but as the production of gasoline with a good color involves no expense or trouble for the gasoline manufacturer,

SIMPLEX CAST IRON CONDENSER PIPING



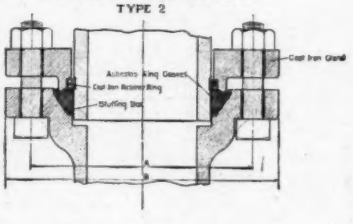
"ONE FLAN GE IS LOOSE"

Settles the Rust Question

Progressive refineries now secure the durability of cast iron pipe in their condenser coils without the disadvantage of standard flanged pipe construction. Our Simplex joint, using a triangular shaped, endless asbestos gasket, is the secret. It is fully described and illustrated in our Catalog No. 55. Your copy is ready to be mailed upon receipt of your request.

Do you know why cast iron resists corrosion so much more than other ferrous metals? Our Bulletin No. 44 explains it.

CROSS SECTION OF ASSEMBLED JOINT
SIMPLEX CONDENSER PIPING
TYPE 2



Dimensions A and B are American Standard for 125 lbs. pressure

AREA PER LINEAR FOOT

SIZE	CLASS	INSIDE SQ.FT.	OUTSIDE SQ.FT.
8	AB	.6934	.1051
8	CD		.1047
6	A	.1672	.1309
6	B-D		.1310
6	A	.1378	.1863
6	B-D		.1859
8	AB	.2844	.2600
8	CD		.2618
10	AB	.3892	.2199
10	CD		.2985
12	AB	.5118	.3665
12	CD		.3665

Write for Simplex Condenser Catalog Number 55

AMERICAN CAST IRON PIPE COMPANY

General Offices and Foundry: Birmingham, Ala.

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Write Also for information on Our Prepared Joint Cast Iron Pipe for Oil Lines

the perfectly sound custom has arisen of requiring at least 21 Saybolt color for gasoline to be used in such a manner.

Gravity

Gravity is somewhat more difficult to agree on. In the first place, the gravity specification which the gasoline manufacturer can meet depends considerably upon the quality of the wet gas he has to work with. Thus rather definite gravity limitations are set by the fields in which the natural gasoline is manufactured. For instance, in California the natural gasoline produced in fields such as Inglewood, Torrance and the San Joaquin Valley is low, ranging from 60 to 75 degrees A. P. I. This assumes the manufacture of gasoline from wet field gas and not from high pressure main line gas which has been previously put through gasoline plants. In other California fields, the natural gasoline varies roughly from 75 degrees to as high as 90 degrees A. P. I.

To many buyers of natural gasoline, gravity is of no particular interest because they buy the product primarily in order to get a low initial for their finished motor gasoline. Those refiners, however, who are buying natural gasoline for the purpose of blending to a high gravity in their finished gasoline very naturally are more interested in buying natural gasoline with as high a gravity as possible. Therefore, other things being equal, they are willing to and can afford to pay a higher price for high gravity natural gasoline than for equally good natural gasoline with a lower gravity.

Limiting End Point

In the writer's opinion there is only one object in limiting the end point of natural gasoline and that is to protect the buyer from being sold absorption oil when the natural gasoline is manufactured by the oil absorption process. Therefore, the end point should not be placed so low that the gasoline manufacturer is unable to include in his salable product those relatively heavy drips which come to him through his gas lines. He is clearly entitled to sell this product as natural gasoline just as much as any of the lighter constituents of the gas which he is treating. An end point of 375 degrees Fahrenheit would seem to make possible the inclusion of drips and yet exclude any appreciable amount of absorption oil.

Vapor Pressure

In attempting to arrive at vapor pressure specifications we immediately encounter difficulties. If rail deliveries are contemplated, the upper limit of vapor pressure is set by the Interstate Commerce Commission regulations. If pipe line deliveries are made, there is no particular limit to the vapor pressure other than that agreed upon between the buyer and seller. The tendency in California has been for natural gasoline buyers to require vapor pressures of 10 to 15 pounds per square inch at 100 degrees Fahrenheit. In exceptional cases, vapor pressures as high as 20 pounds per square inch (the Interstate Commerce Commission limit) have been permitted. The writer takes the viewpoint that inasmuch as a very large portion of the natural gasoline bought by refiners in California is cold blended with refinery naphtha, the proper limitation of the vapor pressure would be the best safeguard which the buyer has against inordinate blending losses. Vapor pressure is a direct measure of the amount of gasoline which will evaporate due to handling without further processing such as redistillation.

Despite the obvious theoretical advantages of specifying vapor pressure there are practical difficulties which have brought this specification into disrepute. It is difficult to check vapor pressure determinations against one another, even if identical apparatus is used. Also there are cases known to most of us in which the vapor pressure of natural gasoline has radically changed in transit from seller to buyer. These changes are rather difficult to explain definitely authough plausible reasons can easily be advanced. The upshot of the whole matter is that because of the possibility of the vapor pressure changing it is difficult to avoid disputes between buyer and seller. For these and other reasons, the natural gasoline industry east of the Rocky Mountains has practically abandoned vapor pressure specifications for purposes other than compliance with Interstate Commerce Commission shipping requirements. The probable tendency here on the Pacific Coast will be to follow suit.

Low Boiling

A question which is often discussed in terms of vapor pressure is the inclusion of very low boiling hydrocarbons in natural gasoline. It is premature at the present time to discuss with any assurance the question of how much butane and propane, if any, the natural gasoline manufacturer should include in his product. Elaborate research work is now being conducted on this problem which should yield very valuable results in the near future. It is probable that the production of good natural gasoline in California can be very greatly increased by the proper inclusion with the pentane and higher fractions of 50 per cent or more of the butane content of the average natural gas treated. The inclusion of all the butane and even the inclusion of propane are being discussed but the wisdom of this step is open to considerable question.

In the meantime the inadequacy of our knowledge of this subject makes it inadvisable to attempt to propose at this time a reasonable specification within hard and fast limits for natural gasoline. Both the refiner and the natural gasoline manufacturer have learned much within the last year or two and unquestionably still have much to learn.

Distillation Recovery

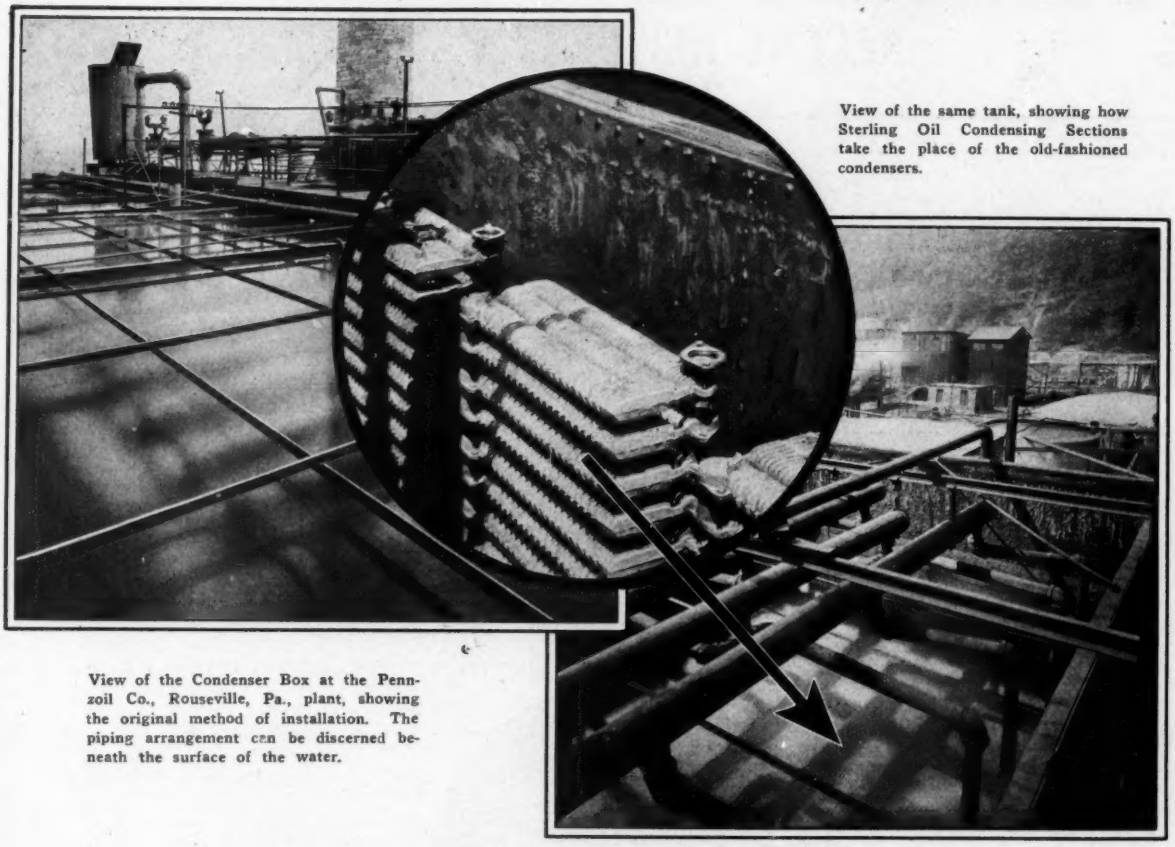
It is in connection with the specification of distillation recovery that the most damage has thus far been done, both to the refiner and the natural gasoline manufacturer. The refiner as the buyer has been the chief sinner in this regard. In attempting to protect himself against buying a wild gasoline, he has attempted to place the distillation recovery requirement as high as possible. Experience has shown that recovery requirements in the neighborhood of 85 per cent are both reasonable and fair. There are several glaring instances, however, in which the recovery specification has been placed as high as 90 per cent, and even higher, without paying the price which such a stable gasoline should obtain.

It costs money for the natural gasoline manufacturer to make a product containing the maximum amount of low boiling hydrocarbons, and yet have a high distillation recovery. If the refiner is willing to pay the price for the considerable additional investment and operating costs involved in manufacturing such a gasoline, well and good. That is his privilege. For the refiner to insist upon the delivery of a natural gasoline with a recovery of 90 per cent and higher manufactured in the type of plant now generally in use leads to the penalizing of both parties to the arrangement. The gasoline manufacturer is forced to weather or otherwise remove and exclude from his product a large proportion of the hydrocarbons which are most valuable to the refiner, thus cutting his own production anywhere from 10 to 40 per cent.

In a market like the present where the refiner is anxious to get all the good natural gasoline he can, the buyer who insists on such recovery requirements is hurting himself seriously, both by arbitrarily reducing the amount of natural gasoline which the manufacturer can deliver to him by forcing the latter to remove from his product a large proportion of the low boiling hydrocarbons which would be most valuable to the buyer.

Miscellaneous Tests

In special cases it is necessary for the buyer of natural gasoline to protect himself against delivery of a product with a high sulphur content or high gum-forming propensities when his own sales specifications require his finished blended product to be free from these defects. Also there are cases in which it is conceivably desirable to limit the initial boiling point. There are also other limitations which special conditions might require but all these are properly the subject for agreement between prospective buyers and sellers and need not be given consideration in any set of specifications which it might be desirable in the future to propose for the use of California dealers in natural gasoline.



View of the same tank, showing how Sterling Oil Condensing Sections take the place of the old-fashioned condensers.

View of the Condenser Box at the Pennzoil Co., Rouseville, Pa., plant, showing the original method of installation. The piping arrangement can be discerned beneath the surface of the water.

How STERLING OIL CONDENSING SECTIONS
saved these corroded condenser boxes

EVEN THOUGH the condenser boxes shown at the left above became so badly corroded at the water line that they could no longer be used with old-fashioned condensers and even though the plant passed through a disastrous fire which further weakened the boxes so that they were unsafe for the depth of water indicated in the photograph, it was not necessary to build new boxes.

The Pennzoil Company, refiners of Pennsylvania crude oil, found that by installing Sterling Oil Sections they had the same amount of surface but were able to lower the water line to a point where the condenser boxes could be used with absolute safety. The photograph at the right above shows the position of the new water line, under which condition the boxes are entirely satisfactory. It shows, too, the corroded condition of the upper part of the box where the old water line came.

The Pennzoil Company not only saved the cost of new boxes, but through the installation of Sterling Oil Sections actually increased the efficiency of the old box.

Many advantages and uses of Sterling Oil Sections are described in our illustrated catalogue. We shall be glad to send you a copy on request.

STERLING OIL SECTIONS
For manifold use - for continuous use - for cooling

AMERICAN RADIATOR COMPANY

40 West 40th Street, New York, N. Y. 816 So. Michigan Avenue, Chicago, Ill.

Sterling Oil Sections are immediately available at our plants in KANSAS CITY, MO., SPRINGFIELD, OHIO, BUFFALO, N. Y.

RECENT REFINERY PATENTS

BY STAFF REPRESENTATIVE

Washington, D. C.—The following patents of interest to the refinery industry were granted by the United States Patent Office during January:

No. 1,568,157, granted January 5 to Francis M. Hess, Whiting, Ind., for a method of effecting continuous distillation, the steps or operations of which consist in causing the crude material to flow by gravity through a series of vapor boxes, passing a heating agent through said vapor boxes out of contact with the crude material and in counter-direction to the flow of the latter, simultaneously passing the vapor given off by one of said vapor boxes through a higher vapor box out of contact with the crude material flowing through the latter, and simultaneously passing the residuum from the lowermost vapor box upwardly through a higher vapor box out of contact with the crude material flowing through the latter.

No. 1,568,181, granted January 5 to George L. Pritchard and Herbert Henderson, Port Arthur, Texas, assignors to Gulf Refining Company, Pittsburgh, Pa., for a process for making aluminum chloride, comprising preheating a mixture of aluminous material and carbon, tumbling said mixture down a reaction zone and passing chlorin in contact with said mixture in an opposite direction to produce vapors of aluminum chloride, conducting said vapors away from the reaction zone and condensing them.

No. 1,568,182, granted January 5 to John Primrose, New York, assignor to Power Specialty Company, New York, for an oil still comprising in a furnace, a combustion chamber in which intense radiant heat is developed, a heat absorption chamber in open communication therewith, fluid conveying means located in said heat absorption chamber, said heat absorption chamber having wall portions in radiant heat receiving relation relative to said combustion chamber and in heat radiating relation to said fluid conveying means, and means upon said wall to prevent such heat radiation.

No. 1,568,400, granted January 5 to Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Co., Chicago, for an apparatus for cracking hydrocarbons consisting of the combination with an elongated heating coil of a furnace within which said coil is disposed, an enlarged reaction zone, means for passing heated oil from said heating coil to said reaction zone, a dephlegmator disposed away from said heating coil, means for passing generated vapors to said dephlegmator, means for withdrawing unvaporized oil from said reaction zone without permitting entrance thereof to the heating coil, a conduit leading from said dephlegmator, a pump communicating with said conduit a communication between said pump and said heating coil for introducing reflux oil to the coil under pressure, and means for admitting reflux oil from said dephlegmator continuously to the inlet of said heating coil in the event said pump is shunted.

No. 1,568,812, granted January 5 to William F. Downs, Chatham, N. J., Mary Gardner Downs, administratrix of said William F. Downs, deceased, for a process of increasing the yield and improving the quality of gasoline from vapors of hydrocarbon oils having a boiling point below 500 degrees F., and in which the component parts vary as to their ratios of hydrogen to carbon, and as to their condition of saturation, said process consisting in condensing said vapors in the presence of

A *Mercury* Actuated Temperature Controller

For years manufacturers have striven to produce a temperature controller that could be operated by MERCURY. For it is an acknowledged fact that mercury is the most sensitive, the most accurate and the most durable, when it comes to measuring temperature. That's why nothing has ever replaced mercury for the clinical thermometers upon which human life often depends.

Now we have found a way to operate the time tested, rugged Honeco Controller by mercury.

Honeco

is the only controller operated by mercury.

It makes possible the temperature control of numerous processes in refineries that it has been impossible to handle satisfactorily with gas or vapor tension controllers—especially processes where the bulb is periodically subjected to a temperature considerably in excess of the operating point. No other controller will endure such conditions without injuring its life and accuracy.

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a porous mass containing anhydrous metallic chlorides and continuously withdrawing the liquid condensate from contact with the said chloride.

No. 1,568,813, granted January 5 to William F. Downs, Chatham, N. J., Mary Gardner Downs administratrix of said William F. Downs, deceased, for a process of purifying hydrocarbons, consisting in passing them in liquid form through a filter bed containing metallic chloride maintained in a heated condition, but below the boiling point of the hydrocarbon and below the vaporizing point of the chloride.

No. 1,568,904, granted January 5 to Jacque C. Morrell, Chicago, assignor to Universal Oil Products Co., Chicago, for a process for refining hydrocarbon oils, comprising subjecting the oil separately and individually to the action of sulphuric acid and caustic soda containing litharge, and subsequent to the subjection of the oil to the action of caustic soda containing litharge, adding sulphur dioxide to assist in the refining action.

No. 1,569,203, granted January 12 to Wayne P. Rice, Howard A. Mertz and Chester E. Moore, Ponca City, Okla., assignors to Marland Refining Company, Ponca City, Okla., for a device for removing solid matter from the walls of stills and the like, comprising a member adapted to be introduced into a still, rotatable means mounted on said member and adapted to contact with a wall of said still, and means whereby said rotatable means may be rotated while in contact with said still wall, thus rotating said member.

No. 1,569,433, granted January 12 to Herman Jan Mackenzie and Alexander Wilhelmus Steenbergh, Tjepoe, Java, Dutch East Indies, assignors to De Bataafsche Petroleum Maatschappij, The Hague, Netherlands, for a process for obtaining commercial gasoline from gasoline-containing gas, comprising compressing such gas, cooling the compressed gas to normal temperature while maintaining the compression pressure and separating out the resulting natural gas gasoline under pressure, then mixing the natural gas gasoline with blending gasoline, cooling the mixture to a relatively low temperature while maintaining it compressed, then releasing the pressure on the mixture to atmospheric pressure, then separating out the resulting gas from the liquid, the mixture being gradually brought to atmospheric temperature after the pressure has reached atmospheric, the separating out of the gas from the liquid being progressive and occurring over the entire period during which the mixture is coming to atmospheric temperature.

No. 1,569,532, granted January 12 to Harold R. Berry, Brooklyn, N. Y., assignor to The Dynamics Corporation of America, New York, for a process of cracking and converting hydrocarbon oil, which consists in continuously introducing hydrocarbon oil into an enlarged zone, and continuously and separately introducing into said zone substantially undiluted steam of such volume and at such temperature that such carbon as is released by the cracking of the hydrocarbon oil is converted into carbon oxides by union with oxygen from the steam before such carbon can be deposited upon the zone wall, the specific gravity of the resulting hydrocarbons being lowered by the reactions.

No. 1,569,855, granted January 19 to Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Co., Chicago, for a process of treating hydrocarbon oils, comprising introducing a supply of oil to a still, in heating the still, in passing the vapors generated from the oil in the still through a filtering bed located in the vapor space of the still above the oil level and above the oil inlet thereto, in subjecting the vapors to dephlegmation in discharging uncondensed vapors and in returning reflux condensate to the still below the filter bed.

No. 1,569,870, granted January 19 to Jacque C. Morrell, Chicago, assignor to Universal Oil Products Co., Chicago, for a process for refining and purifying mineral oil, consisting in subjecting the oil to the action of alkali metal plumbite in water solution, in then removing substantially all the alkali metal plumbite solution from the oil, in then treating the freed oil with a metallic sulphide capable of hydrolyzing in water

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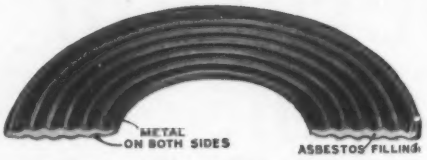

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to complete the reaction of the plumbite solution, and in then removing the separated precipitate and sulphide compounds.

No. 1,569,871, granted January 19 to Jacque C. Morrell, Chicago, assignor to Universal Oil Products Co., Chicago, for a process for refining hydrocarbon oil, consisting in subjecting the oil to treatment with sodium plumbite in water solution, in extracting the sodium plumbite solution, in then introducing a sulphide in water solution, withdrawing the products of this reaction and then introducing a flocculating agent to precipitate the other products of reaction, and in then withdrawing the precipitated material.

No. 1,569,872, granted January 19 to Jacque C. Morrell, Chicago, assignor to Universal Oil Products Co., Chicago, for a process for refining cracked hydrocarbon oil, consisting in subjecting the oil to an alkali metal plumbite in water solution, agitating the mixture, in then extracting the plumbite solution from the oil, in then introducing sulphide in water solution to the oil to assist the reaction caused by the plumbite, in then removing the sulphide with any products of reaction.

No. 1,570,005, granted January 19 to Herman Reinbold and Hugo Reinbold, Omaha, said Hugo Reinbold assignor to said Herman Reinbold, for the use of hydrous silicic acid in combination with a metal chloride as a medium for bleaching, cracking and desulphurizing petroleum and other hydrocarbon compounds.

No. 1,570,131, granted January 19 to Roland B. Day, Lansdowne, Pa., for the production of low boiling hydrocarbons from boiling hydrocarbon oils, by a process which comprises maintaining body of liquid extending from the interior and top of said first chamber and constantly connected by a communicating body of liquid with the oil of said first chamber, said communicating body of liquid with the oil of said first chamber, said communicating body of liquid extending from the interior and top of said first chamber to the interior and bottom of said second chamber, applying heat to the exterior of said first chamber sufficient to crack some of the oil therein, and leading off aeriform products from above said pool of oil, the even heating of liquid within said first treatment chamber being effected and the formation of carbon on the inner surface of the walls of said first chamber being prevented solely by violently agitating the liquid material continuously during the application of heat to said first chamber.

No. 1,570,170, granted January 19 to Alfred Oberle, Oak Park, Ill., assignor of one-half to Thomas E. Scofield, Kansas City, Mo., for a process for extracting vanadium from petroleum hydrocarbons, which consists in treating the hydrocarbons to drive off the volatile materials and subjecting the residue to a bleaching action with a vanadium sol-

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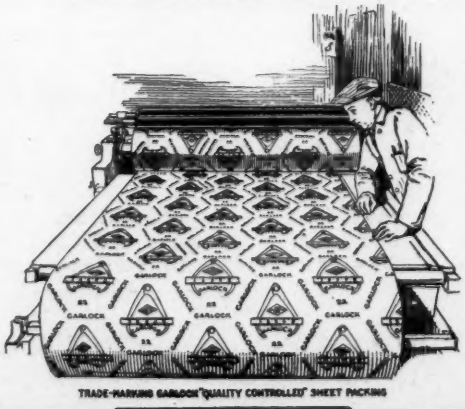

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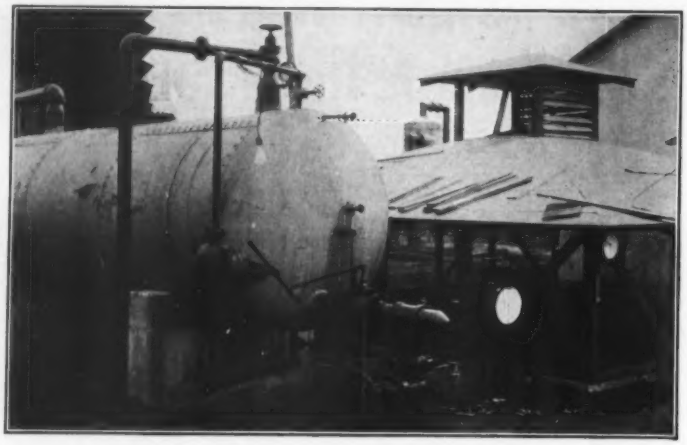

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vent fluid to recover the vanadium compounds therefrom, removing the solvent and recovering the vanadium compounds.

No. 1,570,205, granted January 19 to Davis C. Collier, Santa Fe, N. Mex., for a method of separating oil from oil-bearing sands and the like, which consists in mixing such material with water and subdivided carbonaceous material, and then subjecting the material to agitation, whereby the oil and carbonaceous material are agglomerated, and float on the water while the sand settles out.

No. 1.570,209, granted January 19 to Jan Heinrich Christoph de Brey, The Hague, Netherlands, assignor to Naamlooze Vennootschap Bataafsche Petroleum Maatschappij, The Hague, for a process for separating the phases of emulsions, and more particularly of petroleum emulsions, comprising, applying to the emulsion to be treated a pulsating alternating current having a peak voltage which is a multiple of the effective voltage.

No. 1,570,890, granted January 26 to Frank W. Hall, Port Arthur, Texas, assignor to The Texas Co., New York, for a process of treating hydrocarbon lubricating oils that comprises passing the oil, substantially free from water, through a mass of absorbent clay.

Independent Converting Old Plant Into Modern Refinery

Tulsa, Okla.—As its entry into the refining branch of the industry, the Independent Oil & Gas Company has taken over two plants in Okmulgee and is now converting both of these into one modern plant.

The plant of the Allied Refining Company was bought as a going concern. Adjoining it, the idle plant of the old Indiahoma Refining Company was taken. The two, with improvements, will form the Independent's refining unit.

One Jenkins cracking unit is now being installed. Around this will be built a complete refinery, capable of handling 4000 barrels of crude oil daily. A lubricating plant is being built, as well as a filtering plant. The plant is now running around 2000 barrels daily.

R. M. Riggins, secretary and treasurer of the company, is general manager of refining. Improvements are being outlined by E. B. Hickman, chief engineer of the company. Operation of the plant is under J. W. King, who was superintendent of the Allied plant when it was bought.

Along with its entry into refining, the Independent has inaugurated a vigorous sales campaign and output of the plant will be sold under a trade mark.

The Independent owns pipe lines into the Okmulgee territory capable of handling 7,000 barrels of crude daily. Present runs are around 3,500 barrels. Storage at Okmulgee consists of 15 tanks of 55,000 barrels capacity.

EXTRACTS OF REFINING TECHNOLOGY

Natural and Prepared Bleaching Earths—In the German magazine Petroleum Zeitschrift, 1926, pages 16 ff, there is contained an article in which there are described tests which were made on the determination of the relative bleaching capacities of various natural and prepared bleaching earths, as used in the petroleum industry.

The article is mainly concerned with the tests that were made on the artificial bleaching earth which is made by Bayer, and which has been said to be possessed of very favorable properties. There has been some question about the real potency of this earth, and the objections are answered in the article. One property of this earth which has been objected to is its acidity, and of this there is no question but the amount of the acidity is very small, only .02 to .04 per cent HCl. Tests have shown that this bleaching earth can be regenerated with the result that its bleaching properties are restored in part.

* * *

Cracking of Heavy Oils at Ordinary Pressure—In the process of cracking heavy oils under ordinary pressures, which is described in the Bull. Fed. Ind. Chim. Belg., 1925, pages 16-20, 20-83, the catalysts which are employed are metals which are heated to a temperature of 550 to 600 degrees C. Thus for example iron turnings are heated in tubes. Then at periodic intervals a certain quantity of superheated steam is led through the tube for the purpose of preventing the deposition of particles of carbon. When mineral oil, having a specific gravity of .860 at 80 degrees C. is treated by this process, there are obtained approximately 420 cubic meters of gas, 275 liters of benzine, having a boiling point of 187 degrees C. and 184 liters of tar per metric ton of oil.

The gas obtained contains 40 to 45 per cent of unsaturated hydrocarbons, from 35 to 40 per cent of saturated hydrocarbons, from 10 to 15 per cent of hydrogen and from 4 to 5 per cent of benzine.

When the process is carried out at a temperature in excess of 650 degrees C. then the yield of gas rises to approximately 500 cubic meters per ton of oil, and the gas will then be found to contain a considerably greater amount of hydrogen. The illuminating power of this gas will then correspond to that of acetylene. The heating value per cubic meter is from 14,000 to 16,000 calories. The gas can be used for a variety of heating and lighting purposes and also in the cylinders of the internal combustion engines.

* * *

Conversion of Mineral Oils Into Colloidal Systems—The view is often held that a mineral oil, as long as it shows the required specific gravity, tarring number, etc., is to be considered as having undergone no change. But a mineral oil is never an individual system, as for example benzol, but a dispersive system with at least two phases, of which one is a mixture of low molecular weight hydrocarbons and the other a mixture of high molecular weight hydrocarbons. The behavior of these two phases towards one another must be considered in the same light that will produce a colloidal solution of gelatine in water. The role that the water plays in the gelatine colloidal solution is taken by the low molecular weight hydrocarbons in this case.

It is known that very often the water is held very firmly in the colloid, so that it is very difficult to free the colloid entirely of water. It is also known that metallic vessels, which are perfectly impervious to water, are often pervious to oils. This and other phenomena show that oil possesses the power to infiltration into the finest kind of capillary spaces. This property is made use of in the employment of oils in electric transformers and switches.

Examination which has been made of oil samples which have been in use for a prolonged period of time have shown that the effect of oxygen is to change the oil until it attains the appearance of an asphalt, if sufficient time is given to the oxygen to exert its oxidizing effect. It must therefore be reckoned with that oils which have been used in transformers and switches for a prolonged period of time become acid and therefore worse. The author would recommend that such oils can be regenerated and their bad properties removed by subjecting them to treatment with silicates. Very good results are obtained and the technical operation of the process is free from too great difficulties. If it is considered that in this manner the colloidal status of the mineral oil is changed, then this gives us an insight into the complexity of oil chemistry and into the really complicated character of the mineral oil. Zeitschrift fuer angewandte Chemie, 1925, page 659 ff.

* * *

Determination of Sulphur in Petroleum—At a recent meeting of the Society of Chemical Industry in England there was read a paper on a new method for the determination of the sulphur content in various petroleum products.

In this article there were first discussed the bomb, gravimetric and lamp volumetric methods, and then a procedure for using an improved lamp apparatus was described. The apparatus is seen in the accompanying illustra-

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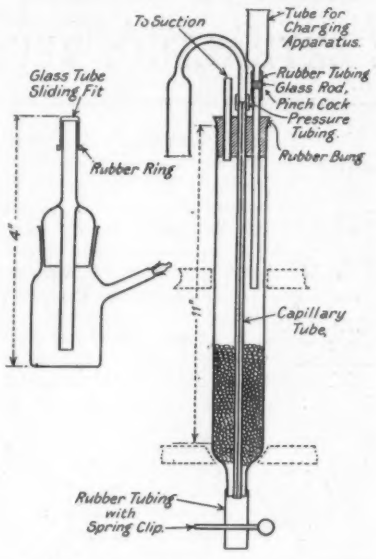
tion. It consists of a modified Esling absorption bulb of limb of the U tube, being eight inches long and at the bottom of this tube there is held a perforated porcelain disc. This limb is half filled with glass spheres of one quarter inch diameter. A small sliding tube outside the top of the wick holder is used to regulate the size of the flame. The titration is carried out with a rapid current of air passing through the solution with methyl red as an indicator. A perfectly sharp end point is obtained under these conditions with one drop of a sixteenth normal solution of sulphuric acid.

The method of procedure is as follows: For sulphur contents between 0.05 and 0.25 per cent one hundred and sixtieth normal sodium carbonate solution is employed, each liter of which contains 3.5 grams of potassium iodate and 25.0 grams of potassium iodide. When the sulphur content is greater than 0.25 per cent, then an eightieth normal solution of sodium carbonate is employed, each liter containing 5.28 grams of potassium iodate and 37.7 grams of potassium iodide.

Ten cubic centimeters of the standard solution are measured into the absorption tube, one cubic centimeter of starch solution and 35 cubic centimeters of distilled water are added. The water should be neutral to methyl red and be measured to within one cubic centimeter. A lamp containing the oil is weighed, placed under the chimney and ignited with a lighted wax taper. The flame is adjusted for light oils to a height of 12 to 15 millimeters and the current of air regulated to the minimum rate that will maintain a clear non-smoking flame.

With heavy oils this height of flame cannot be maintained, a flame of from four to seven millimeters being then



employed. Burning is continued until the end point is reached, which is indicated by the sudden appearance of the well-known starch iodine reaction. The flame is then immediately extinguished and the loss in weight of the oil is measured. The sulphur content can then be obtained for values below 0.25 per cent with the first solution from a curve and above 0.25 per cent with the second solution by calculation. Every ten cubic centimeters of the latter solution is equal to 0.002 gram of sulphur. The Chemical Age of London, 1925, page 577.

* * *

Cracking Ozocerite—The quality and the quantity of the products that are obtained in the cracking of ozocerite in the presence of aluminum chloride depend on the amount of the catalyst that is present while the process is being carried out. The initial distillation temperature of the product falls from 164 to 110 degrees C. as the proportion of the catalyst rises from 5 to 25 per cent. Maximum yields of good quality benzine were obtained when 15 per cent of the catalyst was present. Unsaturated hydrocarbons are also found. It is thought that these experiments may throw some light on the origin of petroleum. Comptes rendues, 1925, volume 181, pages 669-71.

Making Vaseline—In Chemische Zentrallblat, 1925, volume 96, II, page 1644, there is published an abstract of an article that appeared in a Polish journal on a method of manufacturing "vaseline" from Grosny petroleum which contains paraffine. The process consists in purifying the crude oil with the aid of sulphuric acid of comparatively high concentration and then neutralizing the product that is obtained in this manner with the aid of alkali. The technical vaseline is then dissolved in four parts of benzine and the solution is filtered through different absorbents, among the most active being red clay and silica, which is obtained by treating water glass. Another method of filter-

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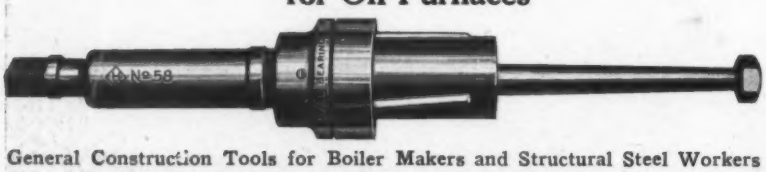

General Construction Tools for Boiler Makers and Structural Steel Workers

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ing consists of stirring the solution with silica. The silica may then be regenerated by heating. The purified vaseline has a red color, is transparent and has a density of 0.905, a viscosity of 2.80 at a temperature of 100 degrees C. and an ignition point of 240 degrees C. (Brenken).

In another process the distillation residues which are recovered from masut, which represent about 50 per cent of the original oil, are decolorized by means of charcoal or kieselguhr. The material, whether liquefied by heating to a temperature of 80 to 90 degrees C. or dissolved in petroleum ether, is only decolorized slowly and to a slight extent by bone charcoal. Kieselguhr may be employed alone in the proportion of two parts per one part of masut, in which case the yield of vaseline is about 44 per cent, or the material may be treated successively with 1.2 parts of kieselguhr and 0.4 part of charcoal, a 47 per cent yield being obtained. The vaseline is colorless and has a melting point of 35 to 36 degrees C. a density at 40 degrees C. of 0.8603 to 0.8611 and a relative viscosity of 1.5 at a temperature of 100 degrees C.

Pacific Gasoline Company Completes Charcoal Plant

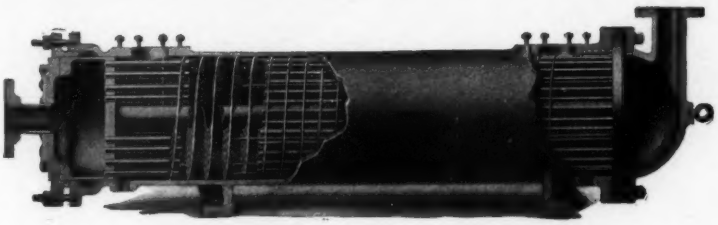
Los Angeles, Calif.—Construction work was completed recently on the Pacific Gasoline Company's charcoal absorption plant on the Associated Oil Company's Lloyd Lease in the Ventura Avenue field. The plant is not far from the company's two oil absorption plants in that field. Gas, after having passed through the oil plants, is treated a second time in the charcoal plant where it is more thoroughly stripped of its gasoline content.

Operation of the plant has been simplified by use of nine 14-inch hydraulic gate valves, which regulate the flow of gas to the three horizontal charcoal absorber stills. Use of these stills might be termed a "batch" process since the passing of gas through the absorber still, the distillation of gasoline from the charcoal and the cooling of the charcoal are carried on successively in each still every three hours.

The plant has a capacity of 6000 gallons daily and is designed particularly for the purpose of treating gas of low gasoline content. It is the first of its kind to be used by the Pacific Gasoline Company and is one of several similar installations in Southern California. Results obtained during the first week of operation have proved exceedingly satisfactory.

New development in the Brea field has called for an enlargement of facilities of the Pacific Gasoline Company in that district. Work has begun on the installation of a gasoline plant which will have a daily output of 2500 gallons when completed. This plant is being built near the site of the first plant constructed by the company which was placed in operation in 1911.

Uses any raw water supply to cool engine jacket water



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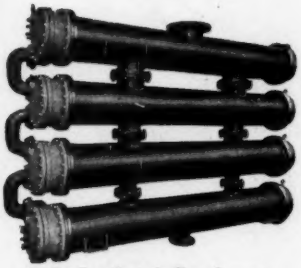

G-R Sectional Condenser
For condensing hydrocarbon vapors and other vapors
Can be used either as a standard or reflux condenser. The sectional arrangement permits using as a condenser and heat exchanger in one set or to obtain a different cut from each section.

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A compact, twin exchanger with strict counter-current flow to promote maximum rate of heat interchange

G-R Vaneflo Gas Cooler
For cooling casinghead or natural gas. Can be used as inter-, after-, or precooler in absorption and compression type natural gasoline plants. Has low pressure loss and exceptional efficiency.

G-R Gasoline Condenser
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- ☐ Sectional Condenser
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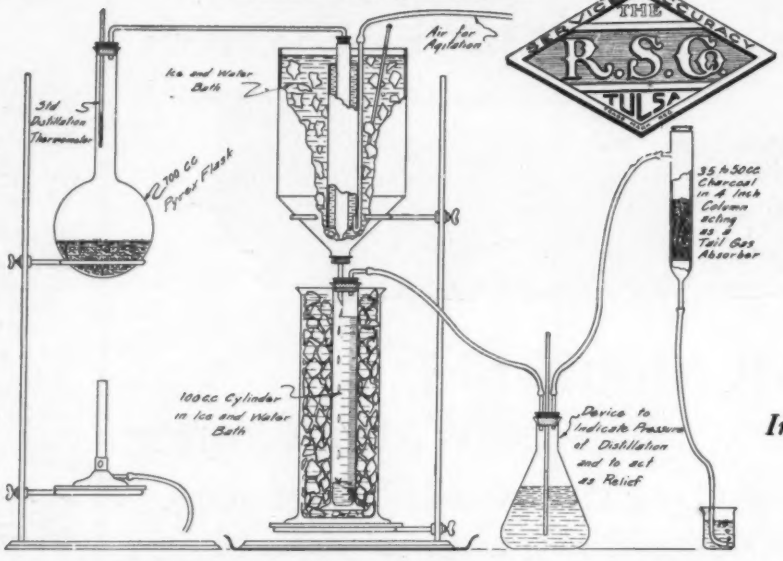
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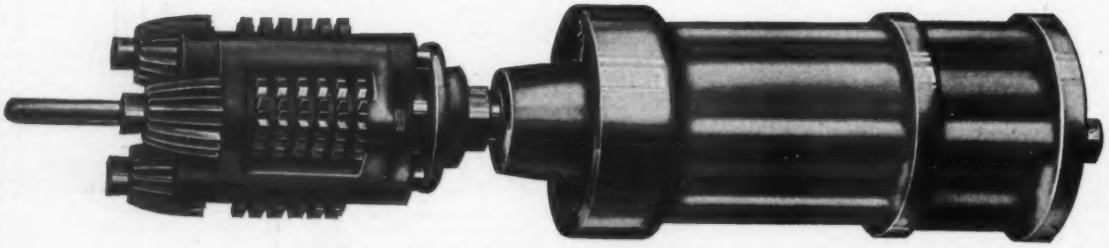

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REFINERY AND GASOLINE PLANT ACTIVITIES

Phillips Petroleum Buys Plant in Texas Panhandle

Amarillo, Texas.—The partially completed natural gasoline plant, machinery and gas contracts by the American Gasoline Corporation of Los Angeles in the Carson-Hutchinson County field, Texas Panhandle district, have been acquired by the Phillips Petroleum Company for a consideration of $300,000. This deal will enable Phillips to further expand its natural gasoline activities during the year in Texas, as sufficient gas is held under contract in the two counties to permit the erection of one or more plants at an early date.

The Panhandle plant acquired by Phillips is one of the Newton type, and has six Clark compressors. It is equipped to handle from 20 to 25 million cubic feet of gas daily when all units are in operation. The gas in the Carson-Hutchinson County field yields from one-half to one gallon of gasoline per thousand, but the yield is expected to become richer after the completed wells have been on the pump for a period. The majority of the gas contracts made with producers in the field are on a basis of 33 1/3 per cent of the gasoline revenue.

The remoteness of the Panhandle oil field from railroad facilities greatly added to the cost of erecting the first plant for the field. The town of Panhandle, located on the Santa Fe Railroad and about 18 miles south of the field, is the nearest shipping point, and Phillips is now stringing a three-inch welded line to transport gasoline from the plant to loading rack at Panhandle. New field work taking place in the lower part of Hutchinson County assures a steady increase in gas supply. Rex McRoy is in charge of the Panhandle plant.

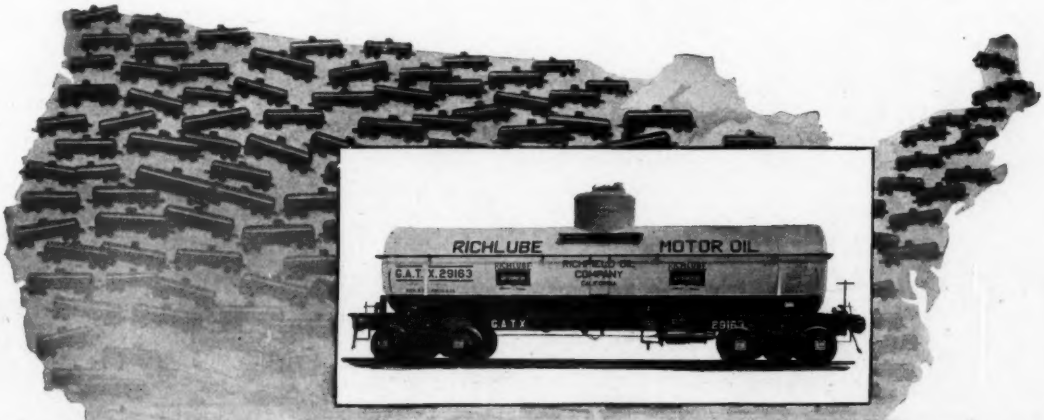
Cottonwood Grove Sorry Spot for Gasoline Plant

"A cottonwood grove is a poor place for a gasoline plant," says R. R. Owen of Ponca City, head of the natural gasoline department of the Marland Refining Company.

Owen speaks from experience and declares that henceforth due care will be taken to see that a plant is not located in the vicinity of cottonwood trees. "The white cottony blossoms of the tree scatter everywhere and penetrate everything, they get into the valves, they clog the pipes and penetrate the most inconceivable places, making it exceedingly difficult to operate plant machinery," says Owen.

Home Plant Sold

Fort Worth, Texas.—The properties of the Home Oil & Refining Company which have been tied up in receivership for a number of years, were sold by court order on January 23, 1926, to Alex Davidson, 2000 California Avenue, San Francisco, Cal., for $190,000. The properties consist of a 5000 barrels daily capacity skimming plant located on a tract of 165.6 acres near Fort Worth. The new owner of the plant will dispose of the physical properties at a later date, and the refinery reservation will be converted into a resident addition.



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The facilities for testing shown in the above cut are representative of the care and thought that have been given to the equipment of the entire shop for building up the excellent reputation which this company enjoys thruout the entire Southwest in every branch of the Oil Industry where plate work is used.

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Permits Granted For Carbon Black Plants

Breckenridge, Texas.—Permits for the construction and operation of four carbon black plants in Stephens and Shackelford Counties have been given during 1925 by the Texas Railroad Commission to Humble Oil & Refining Company, Texas Carbon Industries, Inc., and Phillips Petroleum Company. The latter concern is to erect two plants. These carbon plants will burn residue gas from natural gasoline plants, which have been unable to market the residue heretofore.

The permits are for a period of four years, although the six carbon black plants being operated in Stephens and Eastland Counties have a five year permit. The rection of the four new plants will start shortly, and when completed will burn an aggregate of 21 000 000 cubic feet of gas daily. Humble is to construct its first carbon black plant near Caddo in Stephens County, while the Texas Carbon Industries, Inc., Austin, Texas, will build south of Breckenridge, where it already has one plant in operation. The Phillips Petroleum Company will sub-let its permit for two plants to the Columbian Carbon Company, as was done in the Pioneer field. The Columbian Carbon Company will build a plant to operate in conjunction with Phillips' natural gasoline plants in the Ibex and Ivan fields.

Hanlon Gets Additional Gas Reserves in Texas

Through a deal with The Texas Company, the Hanlon Gasoline Company has acquired additional casinghead gas supplies in the Breckenridge area of West Texas. The Hanlon Company is a subsidiary of Chestnut & Smith Corporation.

The deal does not involve the natural gasoline plant of The Texas Company at Parks but it does give the Hanlon Company broader development play in this prolific gas territory. The Texas Company reserves rights with respect to residue gas.

The Hanlon company also has concluded contract for a large quantity of natural gasoline for delivery to The Texas Company over a long period.

Plant For Mitchell

Colorado, Texas.—The first natural gasoline plant for the Westbrook field, Mitchell County, is to be erected shortly by The California Company, which is the largest lease owner and producer in the field. The plant will be equipped to handle about 300,000 cubic feet of gas daily through the absorption process, and a yield of three and one-half gallons per 1000 cubic feet is obtainable from the gas in the Westbrook field, although the crude only tests 26 gravity. The plant is to be located on the Miller lease, and will require about 40,000 feet of gathering and residue gas lines. Four small booster stations will be used.

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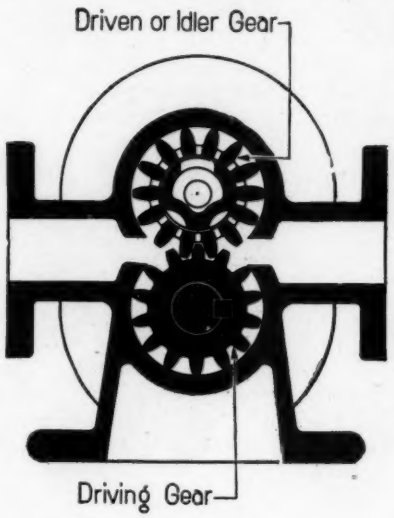

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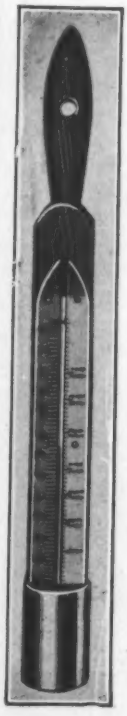

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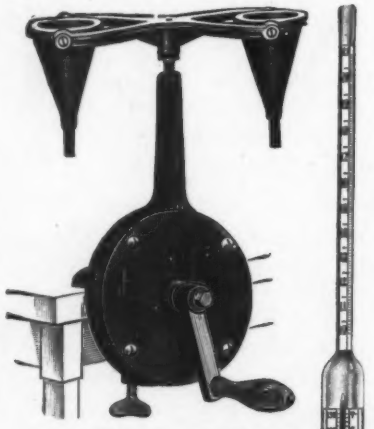

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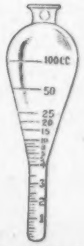

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Universal Files Four More Infringement Suits

Chicago, Illinois.—Further litigation with the several patents on cracking processes involved is promised through the filing of suits against four concerns by the Universal Oil Products Company, owners and licensors of the Dubbs process. Each action alleges infringement on the Dubbs patent.

Information from the Universal Oil Products Company is that the suits have been filed against:

"The Texas Company for its use of the Holmes-Manley Cracking Process, owned by it,

"The Standard Oil Company of Indiana for its use of the Holmes-Manley Process, owned by The Texas Company,

"The Gasoline Products Company of New York and the W. M. Kellogg Company of Jersey City, New Jersey, in connection with the promotion and sales of the Cross Cracking Process.

"The Gulf Refining Company in connection with the operation of its cracking process."

These actions are in addition to suits previously filed by the Universal Oil Products Company against the Skelly Oil Company for the use of the Jenkins Cracking Process, and the Empire Refineries, Inc., for the use of the Brandt Cracking Process.

Reconditioning Plant

Dallas, Texas.—The Lucas Oil & Refining Company has purchased the 2000 barrel skimming plant formerly operated by the State Refining Company at Grand Prairie, near Dallas, and is re-conditioning the plant to start operating in February. The Lucas Oil & Refining Company is capitalized at $500,000 under the laws of Texas, and maintains headquarters on the 13th floor of the Republic Bank building, Dallas. The officers are: B. C. Lucas, president; C. W. Tibbs, vice-president; Fred Watson, secretary-treasurer, and Dan Hobrecht, general manager.

Technical Sessions Set For Equipment Display

Hugh H. Dyar, Chairman of the Cleveland Section of the American Welding Society, C. B. Murray, Secretary of the Ohio Section of the American Institute of Mining & Metallurgical Engineers and T. A. Weager, Chairman of the Cleveland Chapter of the American Society of Heating and Ventilating Engineers, have been appointed members of a special committee representing almost every phase of engineering and chemistry, to co-operate in preparing an unusual technical program to occur throughout the week of May 10th-15th, in conjunction with the Second Chemical Equipment, Machinery and Process Engineering Exposition of the Association of Chem-

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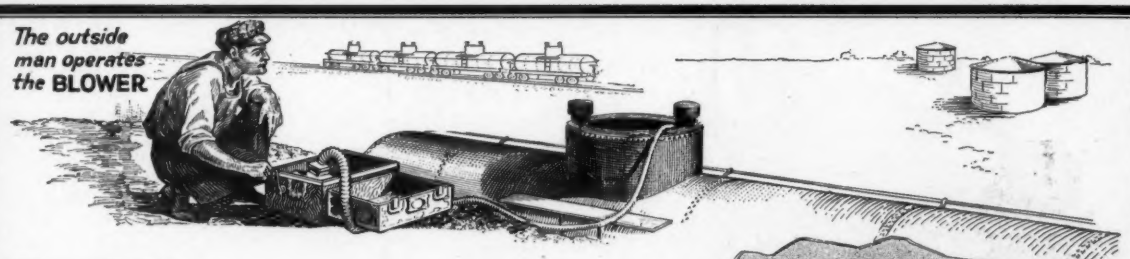

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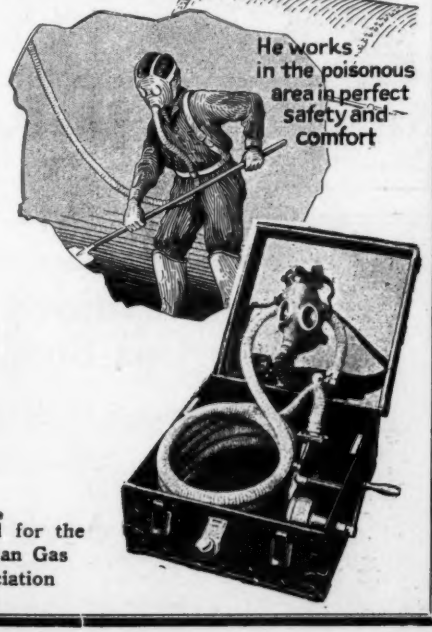

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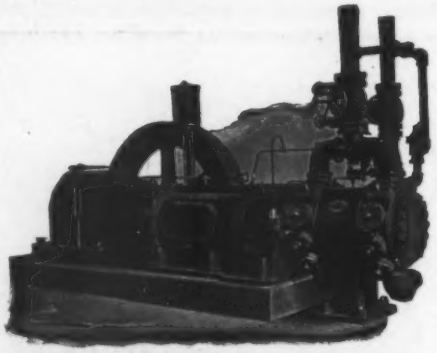

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ical Equipment Manufacturers in Cleveland.

In addition to the sections of these three societies which, through Messrs. Dyar, Murray and Weager, are assuming responsibility for a program unique in its representation of such a wide range of engineering interest, local sections, chapters or membership groups of the American Association of Engineers, Society of Industrial Engineers, American Society for Steel Treating, American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Chemical Society and American Electrochemical Society, are also involved.

The occasion of this inter-related and comprehensive technical program, the Association of Chemical Equipment Manufacturers' Second National Exposition, is a showing of equipment, materials, machinery and accessories basic to the application of all the chemical processes to industrial production.

It will be held in the $6,000,000 Public Hall in Cleveland and will include the latest devices, methods, operating equipment and machinery, etc., used in or adaptable to the use of absorption; precipitation and crystallization; material handling, (solids), (liquids), (gases), (flow of fluids); technology of heat, (combustion), (transfer); refrigeration, disintegration—crushing, grinding and pulverizing; mixing and agitation; mechanical separation; thickening and settling; filtration; hydraulic separation; centrifugal separation; separation—solids from gases; dissolving, leaching and extracting; evaporation; distillation; drying.

The technical program will cover a practical consideration of chemical processes, electrochemical processes, materials of construction with particular reference to ferrous and non-ferrous alloys and rubber, ceramics, mechanical design in relation to crushing and grinding, mixing, precipitation, etc.

It will reflect the inter-relation of the chemical, civil, electrical, metallurgical, heating and ventilating, welding, testing materials, mechanical and industrial engineers and of the chemist, in the application of the "processing idea" in productive industry, with the Exposition as an illustrative and connecting background.

The technical sessions will begin Monday, May 10th and continue throughout the week. They will be held in the Hotel Hollenden, two blocks from the Public Hall. Several of the sections of national technical societies co-operating in this program have invited sister sections within a radius of 500 miles of Cleveland to participate.

A total attendance of 3,000 engineers, chemists and industrial and operating men is assured, making up what will be one of the largest directly interested groups of industrial and technical men that has ever inspected a technological equipment and machinery display.

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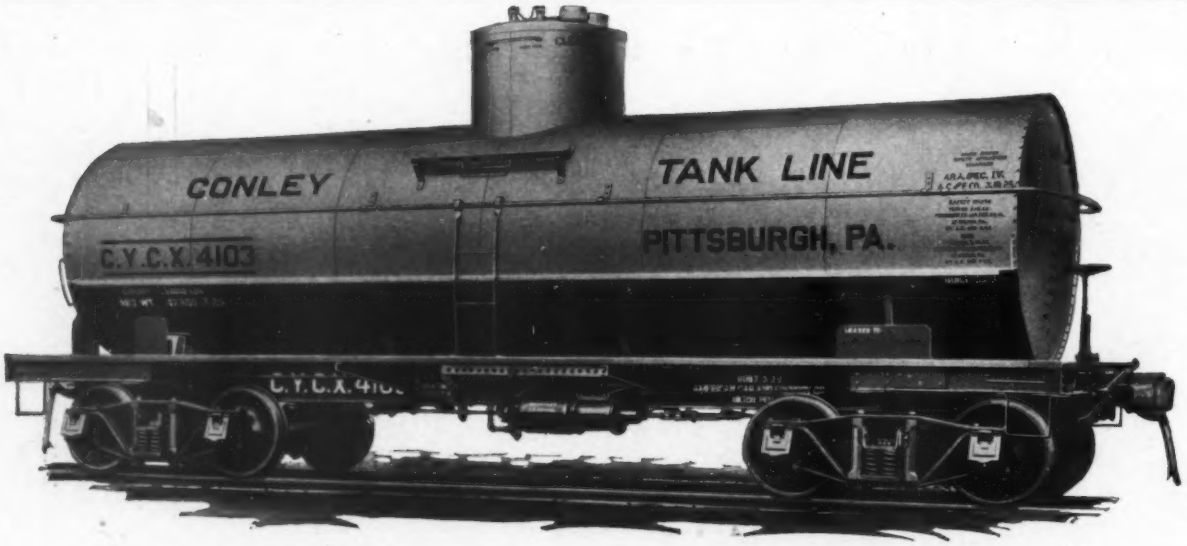

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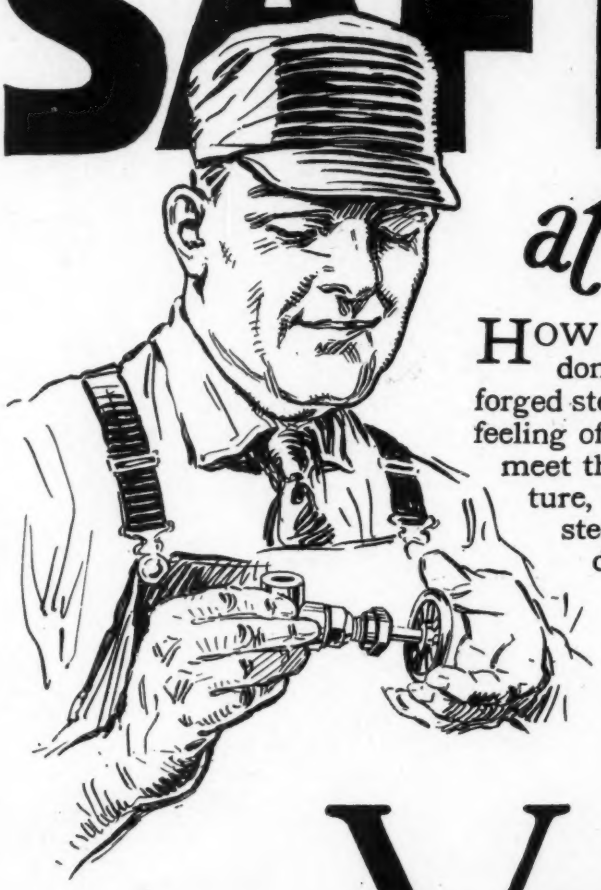

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